NEW COLUMN: ANTIQUE RADIO

MAY 1999

Electronics NOW®

The Y2K Bug

And a Few Other Worries

Survive the Y2K bug with as little fuss and aggravation as possible

Three Video Demodulators

Pull the baseband video out of any RF carrier with these easy-to-build projects

Digital Vegas

A report from the Consumer Electronics Show

A GERNSBACK PUBLICATION

Troubleshooting Monitors And TV Sets

What you see on the screen could be your most important clue to what's wrong inside

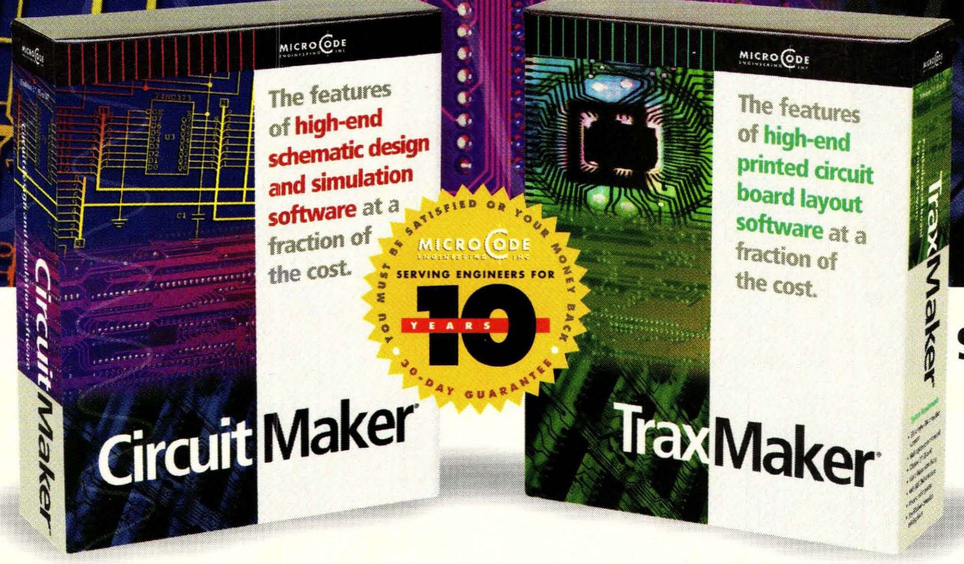
$4.99 U.S.
$5.99 CAN.

#BXNBQWF CAR-RT SORT** C-009
#LRI0424W098 2#751768 0AP61
MAY 00
JOE LORITZ
424 WILSON AVE 03EN
GREEN BAY WI 54303-4115

High-end features. Low-end price.

$299

CircuitMaker 6:
Schematic design
and simulation
software


MICROCODE ENGINEERING INC
The features of high-end schematic design and simulation software at a fraction of the cost.
CircuitMaker
YOU MUST BE SATISFIED OR YOUR MONEY BACK
MICROCODE ENGINEERING INC
SERVING ENGINEERS FOR 10 YEARS
30-DAY GUARANTEE
The features of high-end printed circuit board layout software at a fraction of the cost.
TraxMaker

$299

TraxMaker 3:
Printed circuit
board layout
software

CircuitMaker Version 6 and TraxMaker Version 3 give you the features of professional, high-end software at a fraction of the cost. Plus, with exceptional ease-of-use you'll spend less time learning to use the software and more time designing. Both applications are compatible with your existing software, and feature outstanding technical support. Call now for your free functional demo.

CircuitMaker 6 is a powerful schematic design and simulation program featuring:

- Professional schematic features including printout borders, title block and barred pin names
- Symbol editor and Macro feature for custom devices
- Fast, accurate SPICE3f5/XSPICE-based simulation
- Complete array of analysis types, including Fourier, AC, DC, Parameter sweep, Transient and more
- Virtual instruments including a digital oscilloscope, multimeter, Bode plotter, curve tracer and more
- Extensive library of over 4,000 models
- Tight integration with TraxMaker® for quick PCB layout
- Output PCB netlists in Protel®, Tango® and TraxMaker® formats for use in a variety of PCB layout programs
- Windows 3.1, 95 and NT

TraxMaker 3 is a powerful printed circuit board layout program featuring:

- Over 2,000 component footprints in a fully-documented, indexed library. Documentation shows footprints actual size
- Built-in autorouter and Design Rules Check
- Supports up to 6 signal layers plus power and ground planes, silk screen overlays and solder and paste masks
- Board sizes up to 32" x 32", with no pin limitations
- Intelligent manual routing with unroute capabilities
- Import any PCB netlist in CircuitMaker®, Protel® or Tango® format
- Output RS274X Gerber files, Excellon N/C drill files and Bill of Materials
- Print to any Windows-compatible printer or plotter
- Windows 3.1, 95 and NT

MICROCODE ENGINEERING INC **For free demo software, or to order, call 1-800-419-4242**

927 West Center Street • Orem, UT 84057 • Phone (801) 226-4470 • Fax (801) 226-6532 • **www.microcode.com**

©1998 MicroCode Engineering, Inc. All rights reserved. CircuitMaker, TraxMaker, SimCode and MicroCode are registered trademarks of MicroCode Engineering, Inc. All other brand and product names are trademarks or registered trademarks of their respective companies.

CIRCLE 133 ON FREE INFORMATION CARD

Electronics NOW

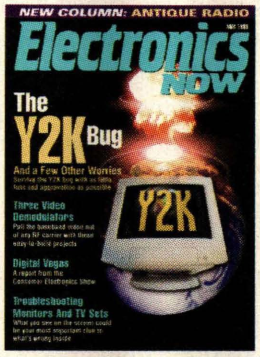
Vol. 70 No.5

CONTENTS

MAY 1999

ON THE COVER

32 The Y2K Bug...And a Few Other Worries



Unless you've been in hiding the last little while, you no doubt are aware of the so-called Y2K bug that some feel could end civilization at midnight on December 31. Well, while nothing that dire is likely to really happen, the end of the century could still cause headaches for many, especially computer users. This month we look at what's behind the Y2K problem, ratchet up your paranoia level just a little bit more by introducing you to a couple of other less publicized but still nasty date-related surprises, and show you how to get through the coming "bug season" as painlessly as possible—if you don't count your New Year's Day hangover. — *Bob Dyball and Greg Swain*

TECHNOLOGY

13 PROTOTYPE

A police-training simulator that shoots back, a traffic-hazard warning system, a sensor that sees like a person, a Motorola chip set that masters multimedia, the right antenna at a glance, and more.

27 DIGITAL VEGAS: NEWS FROM THE 1999 CES

DTV, DVD everywhere, a hard disk for your TV, Polaroid photos from your computer, wireless home networks, and lots more from the recently concluded Consumer Electronics Show. — *Carl Laron*

BUILD THIS

41 DEMODULATE TV SIGNALS WITH A VIDEO IF STRIP

Three low-cost, easy-to-build video demodulators that let you separate the baseband video from nearly any RF signal. If you work with video signals, one of these—or all three—are a must for your bench.— *William Sheets and Rudolf F. Graf*

DEPARTMENTS

6 EQUIPMENT REPORT

Summatec portable hard-drive system.

8 COMPUTER CONNECTIONS

All about the Universal Serial Bus (USB) and why you need it. — *Konstantinos Karagiannis*

10 ANTIQUE RADIO

A new home for an old column, radio designs during the depression, and more. — *Marc Ellis*

20 SERVICE CLINIC

You can often tell what's wrong with a monitor or TV by looking at its screen. Here's a guide to display symptoms, and what they mean. — *Sam Goldwasser*

91 TECH MUSINGS

Will "pulse radio" be the next great thing, brain parity, the work of Richard Feynman, and more. — *Don Lancaster*

AND MORE

2 EDITORIAL
3 Q&A
25 LETTERS
26 NEW LITERATURE
96 NEW PRODUCTS
98 ADVERTISING INDEX
98 ADVERTISING SALES OFFICE

As a service to readers, ELECTRONICS NOW publishes available plans or information relating to newsworthy products, techniques and scientific and technological developments. Because of possible variances in the quality and condition of materials and workmanship used by readers, ELECTRONICS NOW disclaims any responsibility for the safe and proper functioning of reader-built projects based upon or from plans or information published in this magazine.

Since some of the equipment and circuitry in ELECTRONICS NOW may relate to or be covered by U.S. patents, ELECTRONICS NOW disclaims any liability for the infringement of such patents by the making, using, or selling of any such equipment or circuitry, and suggests that anyone interested in such projects consult a patent attorney.

ELECTRONICS NOW, (ISSN 1067-9294) May 1999. Published monthly by Gernsback Publications, Inc., 500 Bi-County Boulevard, Farmingdale, NY 11735-3931. Periodicals Postage paid at Farmingdale, NY and additional mailing offices. Canada Post IPM Agreement No. 334103, authorized at Mississauga, Canada. One-year subscription rate U.S.A. and possessions $24.99, Canada $33.15 (includes G.S.T. Canadian Goods and Services Tax, Registration No. R125166280), all other countries $33.99. All subscription orders payable in U.S.A. funds only, via international postal money order or check drawn on a U.S.A. bank. Single copies $4.99. © 1999 by Gernsback Publications, Inc. All rights reserved. Printed in U.S.A.

POSTMASTER: Please send address changes to ELECTRONICS NOW, Subscription Dept., Box 55115, Boulder, CO 80328-5115.

A stamped self-address envelope must accompany all submitted manuscripts and/or artwork or photographs if their return is desired should they be rejected. We disclaim any responsibility for the loss or damage of manuscripts and/or artwork or photographs while in our possession or otherwise.

Electronics NOW

Hugo Gernsback (1884-1967) founder

Larry Steckler, EHF, CET,
Editor-in-chief and publisher
Adria Coren, Vice President
Ken Coren, Vice President

EDITORIAL DEPARTMENT
Carl Laron, editor
Joseph J. Suda, technical editor
Evelyn Rose, assistant editor
Michael A. Covington, N4TMI
contributing editor
Sam Goldwasser, service editor
Konstantinos Karagiannis,
computer editor
Franklin J. Miller, audio editor
Don Lancaster, contributing editor
Janine Abitabile, editorial assistant

ART DEPARTMENT
Andre Duzant, art director
Russell C. Truelson, illustrator

PRODUCTION DEPARTMENT
Ken Coren
director of desktop production
Ruby M. Yee, production director
Kathryn R. Campbell
production assistant
Michele Musé
production assistant

CIRCULATION DEPARTMENT
Gina Gallo
circulation director
Christina M. Estrada
circulation assistant

REPRINT DEPARTMENT
Marie Mathers
reprint bookstore

Typography by Mates Graphics

Electronics Now is indexed in *Applied Science & Technology Index, Readers Guide to Periodical Literature, Academic Abstracts,* and *Magazine Article Summaries.*
Microfilm & Microfiche editions are available. Contact reprint bookstore for details.

Advertising Sales Offices listed on page 98.
Electronics Now Executive and
Administrative Offices
1-516-293-3000.
Subscriber Customer Service:
1-800-288-0652.
Order Entry for New Subscribers:
1-800-999-7139.

VISIT US ON THE INTERNET AT
www.gernsback.com

EDITORIAL

The End of Everything?

The clock is ticking. When it strikes midnight on this coming December 31st, will the world as we know it end?

Well, if you look at some of the more extreme scenarios being outlined for the end of the century, you might think so.

We don't.

But that does not mean that we should blithely ignore the end of the millennium, and the possible peril it presents to anything that is run by—or that depends on—computers. The potential for chaos is enormous. That's why governments, utilities, and industry are spending billions to get a handle on the problem and make sure any disruption is minimal.

The thing is, as individuals, there is little that we can do about the year-2000 readiness of the major systems that run this county except to take reasonable precautions before that fateful day—and to worry ourselves sick over what probably (we hope) will be no big deal.

However, that's not to say that there is nothing we need to do. In fact, if you own or use a personal computer, you really need to sit down and assess its Y2K readiness. That's especially important if you use that computer in your business. While failure to do so won't cause airplanes to crash, the lights to go out, and banks to go belly up, it could render your personal or business financial records and other data useless. How important that is to you is for you to decide—and to act on.

This month's cover article is a quick primer on the Y2K problem, how and why it affects personal computers, and what you can do to get through the end of the century with as little fuss as possible. If you own a computer, it is in your own best interests to do the tests it describes, and if necessary, implement one of the suggested solutions. If you don't, well, we'll light a candle for you.

Carl Laron

Carl Laron
Editor

Q & A

READERS' QUESTIONS, EDITORS' ANSWERS

CONDUCTED BY MICHAEL A. COVINGTON, N4TMI

Half the Picture

It has come to my attention that Fig. 4 in the February 1999 installment of this column appeared incorrectly—the diagram was drawn properly but a significant portion of it was cut off when the page was laid out for printing, leading to some potentially dangerous confusion. The part of the diagram that appeared showed a variable isolation transformer (with two completely separate windings), but the text also talked about variable autotransformers (Variacs), and this may have given some people the impression that they are the same thing. They aren't, and using an autotransformer where an isolation transformer is needed can be very dangerous. The complete diagram, showing how to combine an autotransformer with a fixed-voltage isolation transformer, was published in our April Letters column.

Also, for the record we note that General Radio (originator of the name Variac) is now known as GenRad. Thanks to reader Nicholas Bodley for pointing this out.

Day Counter

Q *I'm writing about your long-period 30-day timer in the October 1998 issue. I think a photocell would be another good way to do it because the sun rises exactly once per day and you can count sunrises. Enclosed is a possible circuit. — Robert Medeika, Enfield, CT*

A Figure 1 shows your circuit, which we've refined a bit. The basic idea is to generate a digital signal that goes high when the sun is down and low when the sun is up, and then count the transitions.

Photocell LDR1 detects sunlight; LDR stands for light-dependent resistor. It should be aimed at the northern sky rather than the sun itself, so it will see almost the same thing on clear days and cloudy ones. R1 controls sensitivity. One way to adjust it, without going through a whole day-night cycle, is to wait until about ten minutes after sunset, midway between day and night, and adjust R1 so that the voltage across it is half of the supply voltage. Afterward, check that the output of IC1 is high at night and low in the daytime.

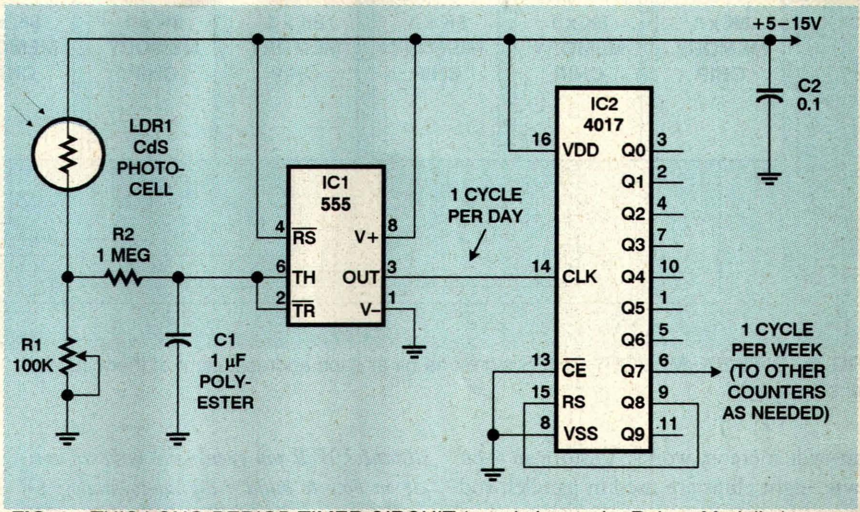


FIG. 1—THIS LONG-PERIOD TIMER CIRCUIT (sent in by reader Robert Medeika) counts days by detecting sunrise and sunset.

A low-pass filter is formed by R2 and C1, introducing approximately a 1-second delay so the circuit won't count lightning flashes or other short fluctuations. A 555 timer, IC1, is used as a level detector; unlike the comparator circuit you originally suggested, the 555 has *hysteresis*, which means the turn-on voltage is higher than the turn-off voltage. That keeps the circuit from "chattering" back and forth between on and off when near the threshold. The 555 output is inverted (low when on, high when off).

The other integrated circuit in the circuit (IC2) is a 4017 (CD4017) CMOS decade counter. By connecting output Q8 to the reset input, we make it count up to 7 and start over again, so its output consists of a single day-long pulse every week. You can feed this to other counters to measure even longer periods. For example, adding a divide-by-four counter (such as a 4017 with Q5 connected to reset) would give you a cycle of 28 days.

A Bit About Bytes

Q *I have several old EPROMs that I would like to use, but I have some questions. Why do the specs list the number of bits (such as 65,536 or 64K) if the memory is organized into 8-bit bytes (8K 8)? Now, supposing the computer can work with a single bit, why are there eight different address lines? And finally, why does each bit have its own address?*

I'm fifteen years old and have been interested in electronics since I was seven. **Electronics Now** *and* Mobile Robots *(Jones and Flynn, 1994) are the only places to learn anything beyond series/parallel circuits and electromagnets! — B. B., Orem, UT*

A The short answer is that they give the bit count because they want to use as high a number as possible; 64K bits sounds more impressive than 8K bytes.

A more serious answer is this: Some memories are bit-wide and some are byte-wide (and some are other widths, such as 4, 16, or 32 bits). Figure 2 shows how a

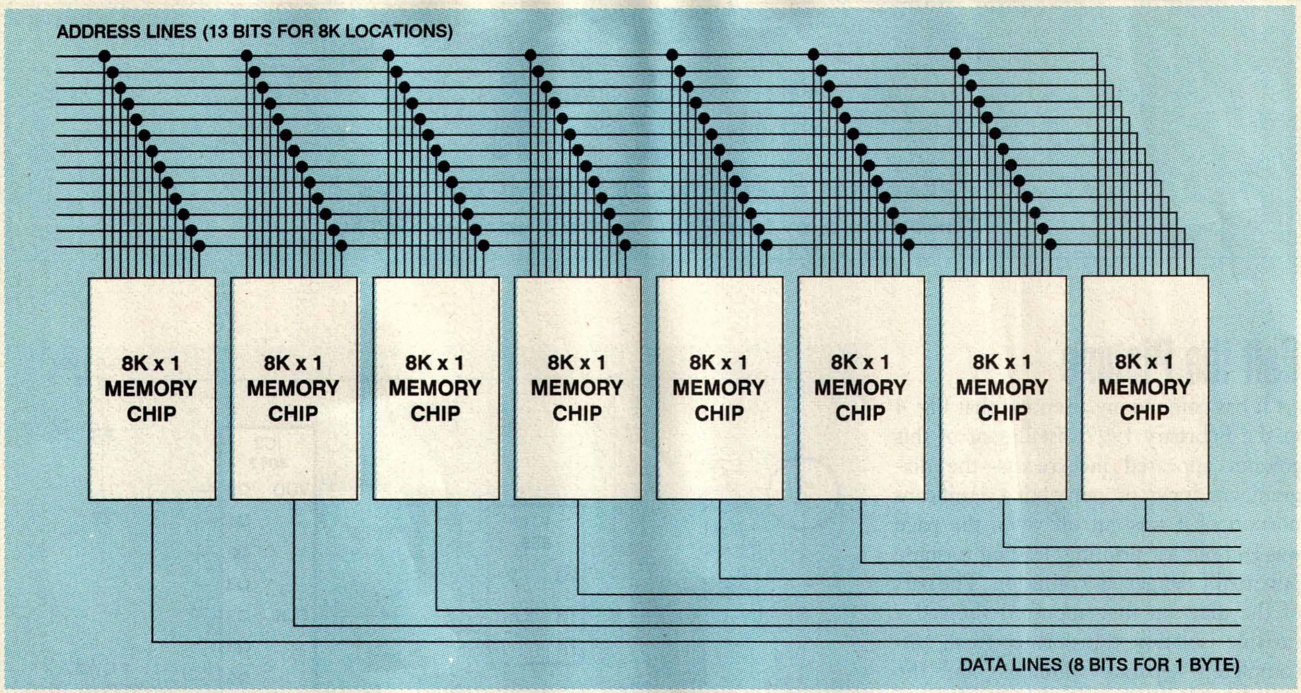


FIG. 2—BIT-WIDE MEMORY CHIPS store one bit at each address; eight of them in parallel store a byte.

bit-wide memory works. To store an 8-bit byte, eight chips are used in parallel, and the address lines are connected to all of them. At the same address, the eight chips store the eight respective bits of the byte—the first bit in the first chip, the second bit in the second chip, and so on.

If the memory is byte-wide, it's like having all eight of the bit-wide chips in one (Fig. 3). You give the chip an address and it gives you all eight bits of data stored at that address. EPROMs are usually byte-wide; for example, the 2764 holds 8K (8192) 8-bit bytes.

The number of address lines depends on the number of locations that need to be distinguished. Each memory location has its own address, and if you have 8192 (8K) locations, you need 13 address lines in order to have 8192 different addresses (because $2^{13} = 8192$).

Your author also got started in electronics at age seven, roughly, but didn't come across any really good textbooks until years later. Let me recommend *The Art of Electronics*, by Horowitz and Hill; the *ARRL Handbook for Radio Amateurs;* and *Experiments with EPROMs*, by Prochnow.

Where's Digital TV?

Q *What frequency band is used for digital television and what type of antenna will be required? What is the expected reception distance? Will you eventually have an article on how to build a digital-to-analog TV converter or is it likely that the chips required will be proprietary?*

According to the newspaper, Los Angeles stations now operating on channels 2, 4, 5, and 7 were slated to start digital transmissions in November 1998. — J. H. M, Sun City, CA

A Throughout its history, TV transmission has been, basically, a problem of data compression. The challenge is to transmit lots of data (enough for moving pictures and sound) through a channel with limited bandwidth (6 MHz). When color TV was introduced in the late 1940s, the channel width remained the same as for black-and-white and some picture sharpness was sacrificed. Even black-and-white TV pictures are rather blurry compared to photographs or computer screen images.

Digital TV will change that by introducing high-definition television (HDTV) along with several standard-definition (SDTV) formats that offer improved picture quality. Digital TV relies on a computer inside the TV set to receive and process the images, which are transmitted with MPEG data compression. MPEG eliminates the need to transmit the entire picture 30 times per second, every time the screen is scanned; instead, only the moving parts of the image are retransmitted. That, together with other compression techniques, makes it possible to transmit about five times as much data on the same channel. HDTV images are twice as sharp, horizontally and vertically, as present-day TV images and will lack the horizontally smeared quality of analog TV. What I noticed when viewing a demonstration was that I could easily see the actors' individual teeth, rather than just a white blur.

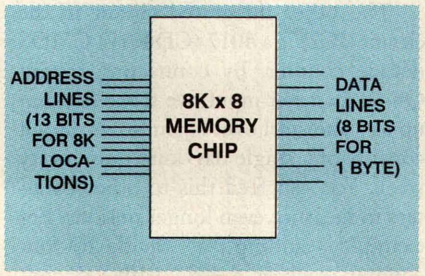

ADDRESS LINES (13 BITS FOR 8K LOCATIONS)
8K x 8 MEMORY CHIP
DATA LINES (8 BITS FOR 1 BYTE)

FIG. 3—A BYTE-WIDE MEMORY CHIP does the work of eight bit-wide chips.

Digital TV will use the same 6-MHz-wide VHF and UHF TV channels that are presently used for analog (NTSC) television. (Japanese non-digital HDTV required extra-wide channels and the United States chose not to adopt it.) During the transition, the FCC has allotted many stations a second channel (usually UHF) so they can start up digital broadcasts without discontinuing their analog broadcasts. For example, KCBS in Los Angeles, Channel 2, is assigned Channel 60 (an existing UHF channel) for digital broadcasts. By 2006,

HOW TO GET INFORMATION ABOUT ELECTRONICS

On the Internet: See our Web site at http://www.gernsback.com for information and files relating to our magazines (**Electronics Now** and **Popular Electronics**) and links to other useful sites.

To discuss electronics with your fellow enthusiasts, visit the newsgroups sci.electronics.repair, sci.electronics.components, sci.electronics.design, and rec.radio.amateur.homebrew. "For sale" messages are permitted only in rec.radio.swap and misc.industry.electronics.marketplace.

Many electronic component manufacturers have Web pages; see the directory at http://www.hitex.com/chipdir/, or try addresses such as http://www.ti.com and http://www.motorola.com (substituting any company's name or abbreviation as appropriate). Many IC data sheets can be viewed online. Extensive information about how to repair consumer electronic devices and computers can be found at www.repairfaq.org.

Books: Several good introductory electronics books are available at RadioShack, including one on building power supplies.

An excellent general electronics textbook is *The Art of Electronics*, by Paul Horowitz and Winfield Hill, available from the publisher (Cambridge University Press, 1-800-872-7423) or on special order through any bookstore. Its 1125 pages are full of information on how to build working circuits, with a minimum of mathematics.

Also indispensable is *The ARRL Handbook for Radio Amateurs*, comprising 1000 pages of theory, radio circuits, and ready-to-build projects, available from the American Radio Relay League, Newington, CT 06111, and from ham-radio equipment dealers.

Copies of past articles: Copies of past articles in **Electronics Now** and **Popular Electronics** (post 1994 only) are available from our Claggk, Inc., Reprint Department, P.O Box 4099, Farmingdale, NY 11735; Tel: 516-293-3751.

Electronics Now and many other magazines are indexed in the *Reader's Guide to Periodical Literature*, available at your public library. Copies of articles in other magazines can be obtained through your public library's interlibrary loan service; expect to pay about 30 cents a page.

Service manuals: Manuals for radios, TVs, VCRs, audio equipment, and some computers are available from Howard W. Sams & Co., Indianapolis, IN 46214 (1-800-428-7267). The free Sams catalog also lists addresses of manufacturers and parts dealers. Even if an item isn't listed in the catalog, it pays to call Sams; they may have a schematic on file which they can copy for you.

Manuals for older test equipment and ham radio gear are available from Hi Manuals, PO Box 802, Council Bluffs, IA 51502, and Manuals Plus, PO Box 549, Tooele, UT 84074.

Replacement semiconductors: Replacement transistors, ICs, and other semiconductors, marketed by Philips ECG, NTE, and Thomson (SK), are available through most parts dealers (including RadioShack on special order). The ECG, NTE, and SK lines contain a few hundred parts that substitute for many thousands of others; a directory (supplied as a large book and on diskette) tells you which one to use. NTE numbers usually match ECG; SK numbers are different.

Remember that the "2S" in a Japanese type number is usually omitted; a transistor marked D945 is actually a 2SD945.

Hamfests (swap meets) and local organizations: These can be located by writing to the American Radio Relay League, Newington, CT 06111; (http://www.arrl.org). A hamfest is an excellent place to pick up used test equipment, older parts, and other items at bargain prices, as well as to meet your fellow electronics enthusiasts—both amateur and professional.

all broadcasters must drop back to using just one channel and transmit only digital broadcasts; analog TV will then be dead and older TVs will not be usable without converters.

You can keep using your present TV antenna as long as it covers the appropriate channels, and you can use your present TV with a converter (set-top box), but if you do, you won't get as much of an improvement in picture quality; to achieve the best possible images will require an all-digital TV. Reception distances will be about the same as with analog TV, or perhaps a little shorter because, like FM radio, digital TV is an all-or-nothing thing: either you get a good signal or you get nothing at all.

Set-top converters will probably be cheaper to buy than to build; they'll contain as much computer power as a PC, and although the chip sets will not be expensive, there will be little or nothing to be gained by assembling your own, since there will be nothing to customize. We'll stay tuned, though (pardon the pun) and bring you any digital-TV-related projects that are practical and useful.

Volume Control Correction

Q *Your push-button volume control ("Q&A,"* **Electronics Now**, *December, 1998) has a possibility of shorting out the power supply if both buttons are pressed at once. Here is a circuit revision that solves the problem. — Ernest Giarrusso, Lompoc, CA*

A You're right. The circuit came from a Philips application note that actually specified a non-shorting spring-loaded switch (SPDT with center off), and in our zeal to avoid hard-to-find components, we changed it to two pushbuttons. Figure 4 shows part of the original circuit and your well-thought-out correction. In both versions, C1 charges and discharges through 2200 ohms; the difference is that you have separate resistors for charging and discharging, so that if both buttons are pressed at once, only about 1 mA of current is wasted. Thanks!

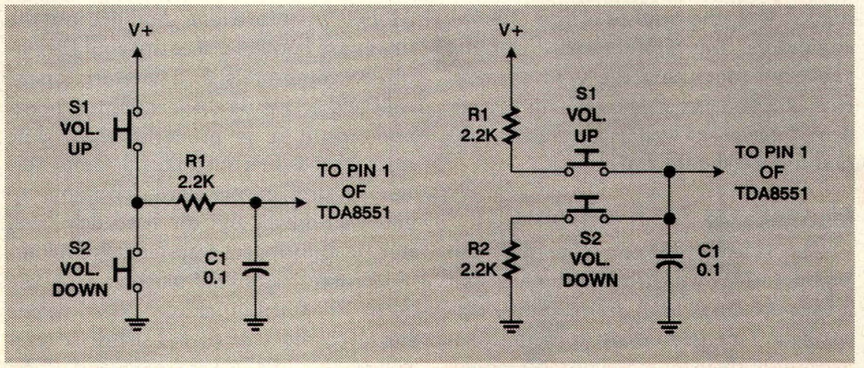


FIG. 4—THE PUSHBUTTON VOLUME CONTROL presented in December 1998 could short out the power supply; reader Ernest Giarrusso's correction solves the problem. Only the affected part of the circuit is shown here.

Battery Magic?

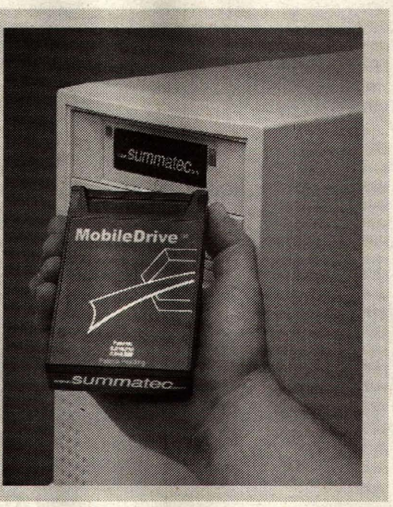
Q *What is the technology described in the enclosed clipping? Why isn't it more commonplace? Is it possible for the average*

Continued on page 12

EQUIPMENT REPORT

SUMMATEC PORTABLE HARD-DRIVE SYSTEM

Summatec's portable hard-drive system is the last removable-media drive you'll ever need—it grows along with your needs.



CIRCLE 15 ON FREE INFORMATION CARD

There are enough removable-media systems on the market to make one scared of plunking down money on any one of them. After all, with all of the different memory technologies, capacities, interfaces, and formats, which one is someone supposed to buy? If you are someone who needs more portable storage space than 1.44-megabyte floppy disks will provide and have been using computers for a number of years, you know what we are talking about as you probably have a number of scrapped removable-storage drives tucked away in the closet. No doubt the disks, cartridges, or whatever else they used are considered ridiculously low in capacity today and might not even be made anymore.

A lot of older portable-drive systems used disks that held about 100 megabytes, but today there are many that provide about a gigabyte of storage per cartridge. Even so, one gigabyte isn't all that much storage space anymore, and the situation will worsen with time. And while a lot of newer systems are compatible with older-style media, it is a certainty that if you have a system that uses one-gigabyte cartridges and a newer-model drive comes out that uses two-gigabyte cartridges, your drive won't be compatible with the newer cartridges.

What's clearly needed is a removable-media system that is not only backward-compatible with older media, but also forward-compatible with future media. And if it's faster than every other removable-media system on the market, then so much the better. Though forward compatibility might seem impossible, Summatec's *MobileDrive* portable drive system does indeed offer it—if you bought one with a one-gigabyte capacity a few months ago, today you can fit five gigabytes into the same hardware. Plus, both the one-gigabyte and five-gigabyte media are faster than anything else with removable data cartridges. The media is also quite rugged, and options for internal desktop use, external desktop use, and notebook computer use are available. How is this all possible?

At the heart of Summatec's portable drive system are actual 2.5-inch IDE hard drives, the type used in notebook computers. You pick the drive capacity you need today, and the type of interface, and you can always pick up a larger drive later on as well as a different type of interface should you need it.

MobileDrive

As stated above, the key to MobileDrive's versatility is the fact that it uses notebook hard drives. Those drives have a rugged design to begin with because of their intended use. Notebook drives are available with capacities as high as desktop drives, and they're just as fast—much faster than any removable-cartridge based system, even if it's Winchester-based. Plus, hard-drive makers are constantly packing in more capacity and lowering prices, so next year you'll pay less per megabyte for additional storage than you do this year.

Summatec wraps the 2.5-inch IDE drives in rugged, shock-absorbing shells that turn the bare drives into durable, portable memory cartridges. The shells measure 3 inches wide by 1 inch high by 5 inches long. At the time of this writing, 2-gigabyte units cost $249, 3 gigabytes $299, 4 gigabytes $399, and 5 gigabytes $499—you always pay a premium for the highest-capacity hard drive.

You need at least one of those "cartridges," and at least one of the following interfaces: The most basic and least expensive interface is an internal docking station for desktop computers. This $149 motorized docking station ($100 when bundled with a drive) installs in a standard 5.25-inch drive bay and the Summatec drive cartridges slide in and out of it. Power comes from the PC power supply and the docking station connects to a motherboard IDE controller. Mounting hardware, IDE, and power cables are included. You don't need to load any drivers with this arrangement.

Because you don't want someone else walking off with your hard drive, a security-key lock option prevents unauthorized insertion or removal of the MobileDrive cartridge. And because the drives are bootable, security could possibly be compromised. Therefore, unauthorized access disables computer operation until it is properly reset. The microprocessor-controlled docking station ensures proper hard drive spin-up and spin-down, and the hard drive will not eject until data transfer is complete.

Another MobileDrive option is the $199 PC-Card interface. That device fits over the end of a hard-drive cartridge, and a PC Card on the end of the attached cable slips into a slot in a notebook computer. Notebook computers instantly detect the plug-and-play drive and open a new drive window on the desktop. No drivers have to be loaded for this option, either.

The third option is a $249 universal parallel-port solution for all computers, notebook or desktop. That external docking bay for the hard-drive cartridges receives power from an included AC adapter and connects to a computer's parallel port. A pass-through connector for a printer is provided. Drivers included on diskette allow a system to control the drive whenever it's attached. Drivers are included for Windows 95, NT, 3.x, DOS, and OS2. You won't get nearly the same performance from this arrangement as you would from either the internal desktop docking station or the PC-Card interface, but it is a universal solution.

Even though Ultra IDE controllers support data transfer rates up to 33.2 megabytes per second, no IDE hard drive can run that fast just yet. But you will see transfer rates between 5 and 10 megabytes per second depending on your particular configuration. Odds are you'll see less than 1 megabyte per second with the parallel port option, as parallel ports just aren't that fast.

Summatec's MobileDrive system offers the best of all worlds in portable storage. There are notebook and desktop options, plus a universal solution. Capacities range from 2 to 5 gigabytes, and that will increase, along with performance, over time. Who could ask for anything more in removable storage? For more information on the Summatec Computer Corporation MobileDrive portable hard-drive system, contact the company directly (368 East Broadway, Vista, CA 92084; Tel: 760-726-7807; Web: www.summatec.com), or circle 15 on the Free Information Card. EN

"That wasn't what I meant when I said to put $10,000 in CDs"

Electronics CD ROMs

produced by:
matrix multimedia

Want to improve your design skills?

Then you should consider our range of CD ROMs by best-selling author **Mike Tooley**.

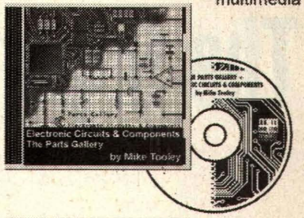
Electronic Circuits and Components provides a sound introduction to the principles and applications of the most common types of electronic components and how they are used to form complete circuits. Sections on the disc include: fundamental electronic theory, active components, passive components, analog circuits and digital circuits. Includes circuits and assignments for Electronics Workbench.

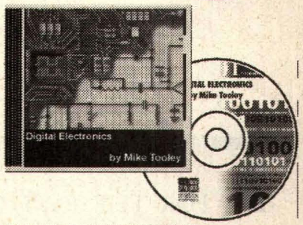
The Parts Gallery has been designed to overcome the problem of component and symbol recognition. The CD ROM will help students recognize common electronic components and their corresponding symbols in circuit diagrams. Quizzes are included. The Parts Gallery is free with Electronic Circuits and Components.

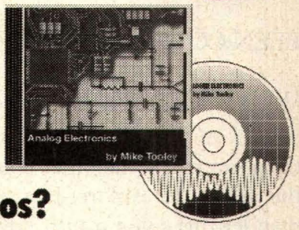
Digital Electronics details the principles and practice of digital electronics, including logic gates, combinational and sequential logic circuits, clocks, counters, shift registers, and displays. The CD ROM also provides an introduction to microprocessor-based systems. Includes circuits and assignments for Electronics Workbench.

Analog Electronics is a complete learning resource for this most difficult subject. The CD ROM includes the usual wealth of virtual laboratories as well as an electronic circuit simulator with over 50 pre-designed analog circuits, which gives you the ultimate learning tool. The CD ROM provides comprehensive coverage of analog fundamentals, transistor circuit design, op-amps, filters, oscillators, and other analog systems.

"...hammers home the concepts in a way that no textbook ever could." Electronics Australia





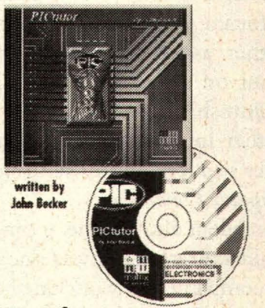


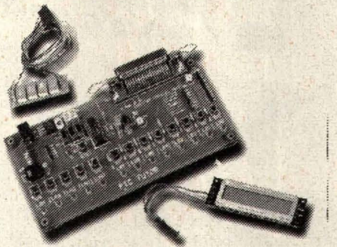
Interested in programming PIC micros?

We have the perfect solution:

Our PICtutor CD ROM can teach you how to write assembly language programs for the PIC series of microcontrollers. The CD ROM's 39 tutorial sections will guide you from basic PIC architecture, commands, and programming techniques up to advanced concepts such as watchdog timers, interrupts, sleep modes, and EEPROM data memory use. Over 80 exercises and challenges are provided to test your understanding, and the unique Virtual PIC allows you to write and test programs on -screen.

The complementary development kit includes a reprogrammable PIC16C84, which you can program via your printer port. The institution version (designed for use in schools, colleges and industry) includes a quad 7-segment LED display and alphanumeric LCD display. The development kit provides an excellent platform for both learning PIC programming and for further project/development work. Assembler and send (via printer port) software is included on the CD ROM.





development board (institution version)

Prices and Versions

Institution versions are suitable for use in schools, colleges and industry.
Student versions are for student/home use.

	student version	institution version
Electronic Circuits & Components	$56	$159
Digital Electronics	$75	$189
Analog Electronics	$75	$189
PICtutor (CD and development board)	$179	$350

Shipping costs to Canada an additional $5. Overseas orders please contact CLAGGK Inc. for shipping costs.

see http://www.MatrixMultimedia.co.uk for full specs and demos

Order Form

Please circle the products you would like to buy on the table above right, calculate the total cost, fill in the form below and send it to us. Please allow 4 - 6 weeks for delivery.

Name: ____________

Address: ____________

Zip: ________ Telephone: ____________

I have enclosed my check for $: ______

Please charge my credit card for $: ______

Note that the delivery address and the address at which the card is registered must be the same.

Card type: ____________

Mastercard, Visa, or Discover only

Signature: ____________

Number: ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

Expire date: ☐☐ ☐☐ ☐☐

CL02

Claggk Inc., PO Box 4099, Farmingdale, NY 11735-0792
Tel: 516-293-3751 email claggk@poptronix.com

BY KONSTANTINOS KARAGIANNIS
COMPUTER EDITOR

The Importance of USB

THOSE OF YOU WHO'VE BEEN FOLLOWING THIS COLUMN FOR THE PAST COUPLE OF MONTHS KNOW THAT WE'VE BEEN COVERING SOME OF THE YEAR'S COMING CPUS. NOW, WHILE WE'VE DETAILED OFFERINGS FROM INTEL, AMD, AND CYRIX, there are still some other contenders in the market to explore. However, rather than let this column turn into a processor forum, we'll shift gears this month to another aspect of modern computing. Count on a look at chips used in new Macintosh machines, as well as glances at other Intel competitors and high-end server vendors, in future installments of *Computer Connections*.

Incidentally, on the topic of silicon manufacturers, Intel was one of the initial companies to work on the development of this month's feature technology, and was the first company to provide silicon for its implementation on motherboards. The technology? Universal Serial Bus, or USB.

Fast and Easy Connectivity

USB is a wonderful interface that took some time to "arrive." Providing automatic switching between two bandwidths (1.5 and 12 Mbps), the interface could handle everything from mice and keyboards (low bandwidth) to scanners and digital cameras (high bandwidth).

While available for a couple of years, USB was essentially useless before the arrival of Windows 98 (iMac computers can also use the bus, thanks to Mac OS 8.1, but more on that later). The highest revision of Windows 95, OSR (OEM Service Release) 2.1, was allegedly able to use the interface, but hardware manufacturers had to write their own drivers, and it was a complicated process getting USB devices to work.

The reason the latter fact was so disastrous was it went against some of the intended benefits of the high-speed interface, namely: hot swapability and true Plug-and-Play. With Windows 98, however, USB devices can be recognized even if they're plugged in while the machine's running. You can then unplug said device while the system is on, and "hot swap" it for another peripheral.

Of course, you probably won't have to swap many USB peripherals, because one of the biggest benefits of the interface is that you can daisy chain up to 127 USB devices on a single computer. These multiple connections can be made in one of two ways.

WITH USB (AND AN APPROPRIATE NUMBER OF USB HUBS), you can daisy chain up to 127 peripherals to your computer, including printers, joysticks, digital cameras, keyboards, and mice.

First, you can physically chain together devices that come with both upstream and downstream ports. For example, you might get a USB keyboard that has an upstream port for connecting a USB mouse. That allows you to have more than one device attached to a single USB port on your computer. As a result of daisy chaining, you'll find yourself reaching for the back of your system's case less often. Unfortunately, not many USB devices come with a passthrough or upstream port.

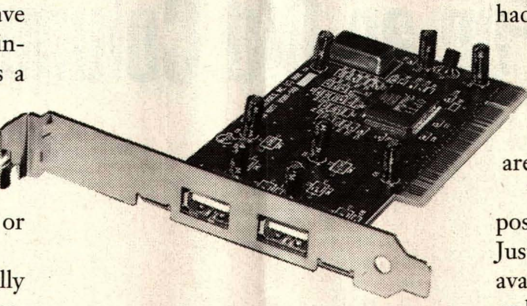
To get the most out of the (usually two) ports on the back of your machine, you'll want to invest in a good quality *powered* hub. Often coming in four- to seven-port versions, hubs allow you to connect multiple devices. By chaining hubs you could, in theory, reach the 127-peripheral limit of USB (just keep in mind that each hub counts as a device).

You might have noticed our emphasis of the word "powered" in the last paragraph. Many USB devices take their power from the bus itself. While this is great for your power strip, which can become less cluttered, it's not so good for your system. The ports in your PC provide about 500 mA of power and will quickly max out if you add a couple of high-drain devices. Expect system bugginess if the latter occurs. To prevent it, use a powered hub that provides current for its devices through a separate AC supply.

A good powered hub to consider is Belkin Components' ExpressBus 4 Port, which, as its name implies, provides you with four upstream ports. It's a dependable investment at $79 (MSRP)—for more connectivity, an ExpressBus 7 Port retails for $109. As with all list prices, shopping around should yield lower street prices.

Another way to get a hub is as part of a USB monitor. Now, while these displays come with USB ports and do connect to your PC's USB port, they still need a standard VGA-cable connection to your system's video card. USB's bandwidth is too limited to handle this type of video; so, in other words, a USB monitor is a standard monitor with a USB hub, and possibly some software control of onscreen settings such as brightness and contrast.

Having just gone into the need for more and more ports, we might have raised the question of why you need them at all. The answer's simple: To take advantage of the expected 250-plus devices that will run on the high-speed interface. In addition to keyboards, mice, scanners, and cameras, you can get simple network solutions (*e.g.* connect two computers with a special USB cable), security sensors (like a thumbprint scanner), printers, external CD-ROM and other drives, joysticks, modems, MPEG-2 digitizers, and more. All usable without opening your system case.



BELKIN'S BUSPORT CARD lets you add USB capability to any Pentium-class or better PC running Windows 98, or Apple machine running Mac OS 8.1 or higher. Just make sure the computer has an open PCI slot.

Unless....

Adding USB to a PC

Does your PC have USB? If it's more than a year old, there's about a 50-50 chance it doesn't, and if it's more than two years old we'd bet it's USB-free. Not certain? Take a look at the back of the case. You should notice one or two thin sockets that look as if they'd just fit the tip of a thick flathead screwdriver. The symbol next to the ports should resemble a trident. Those are your USB ports.

What? Your Pentium-class or better machine doesn't have them? No problem, all post-486 PCs with an open PCI slot can be upgraded to USB using a card like Belkin's BusPort. You'll just need to be willing to upgrade your OS to Windows 98. Of course, that's a judgment call on your part. Win 98 doesn't run very well on machines that are slower than 133 MHz (do ignore the recommended minimum on the OS package), and the OS really needs 166 MHz plus 32MB of RAM to be ... *tolerable*.

If your Pentium-class machine will handle Win 98, the upgrade to USB is a simple one. Turn off your PC and open its case. Insert the BusPort or similar adapter and turn on your computer. Follow the onscreen instructions, insert the accompanying disk, and you're set. It's really that simple (we installed a couple of different types of these cards for a roundup a few of months ago and never had a glitch).

This upgraded version of USB still possesses all the features of a factory-installed interface. The speed, hot swappability, and daisy chaining are all there for the using.

Though we haven't done it, it is also possible to install the BusPort in a Mac. Just make sure the computer has an available slot and is running Mac OS 8.1 or higher.

The BusPort retails for $49. Depending on your needs, installing it, or a card like it, may be the last time you have to open up your computer's case for expansion. Unless you want to add an IEEE-1394 adapter for high-speed video transfer, but that's a topic for another month.

Expanding the iMac

While Microsoft's Windows 98 was much anticipated for its PC USB support, the Windows/PC platform was not the one that really guaranteed USB's success in the marketplace. Apple threw the Wintel world a bit of a curveball last year.

VENDOR INFORMATION

Belkin Components
501 West Walnut Street
Compton, CA 90220
Tel: 800-2-BELKIN
Web: usb.belkin.com

CompuCable Corporation
210-A McCormick Ave.
Costa Mesa, CA 92626
Tel: 714-557-5510
Web: compucable.com

Intel Corp.
2200 Mission College Blvd.
Santa Clara, CA 95052-8119
Tel: 408-765-8080
Web: www.intel.com

Called the iMac, it was a computer sensation. You couldn't watch a half-hour of TV without seeing an ad for it, and not a computer store would dare claim to not have it in stock. While not the fastest computer (it has a 233-MHz G3 processor) it's cheap (now about $1000), attractive, and neatly packaged in an all-in-one design. Unfortunately, it is also a bit flimsy (dropping the keyboard a foot causes many keys to pop

Continued on page 12

BY MARC ELLIS

New Home For an Old Column

GREETINGS **ELECTRONICS NOW** READERS! AFTER SOME TEN YEARS WITH **POPULAR ELECTRONICS**, IT DOES SEEM A BIT STRANGE TO BE IN THIS NEW SETTING—EVEN THOUGH "ANTIQUE RADIO" IS STILL COMING TO YOU THROUGH THE AUSpices of Gernsback Publications. Perhaps some of you who read both books already know about this column. And, I hope, some of you are original "Antique Radio" readers who have followed me here. The change is part of some coverage shifts in both magazines that we feel will better serve the readership in each.

A Little About Me

For those who don't know me or this column, a bit of introduction is in order. I got my start in radio writing, back in the early 1960s, on the editorial staff of the old *Popular Electronics* magazine. At that time, *Popular Electronics* was a Ziff-Davis Publication headquartered in New York City.

I eventually left the company and magazine publishing to continue my career in other forms of communication—doing a short stint as an ad-agency copywriter, and then going on to work for several years as a writer/producer in the educational-film field. Later I became a training program developer for a major corporation, where I stayed for several more years.

During this time, I had kept in occasional touch with my old *Popular Electronics* boss, Managing Editor Julian Martin. As it happened, I was just getting started in antique-radio restoration while I worked for him in the 1960s. And I used to pester Julian for his ideas on such things as how to refresh the lettering on ancient dials and restore the shine to fading Bakelite panels.

During one of the "catch up" conversations we had over the years, Julian encouraged me to start an antique radio column for **Hands-On Electronics,** a new magazine he had begun editing for Gernsback Publications. "You must know a lot about that by now," he commented. I thought it was a great idea! The first "Antique Radio" column appeared in the November, 1986 issue

THE PHILCO MODEL 90 "CATHEDRAL." Photo by Ron Boucher from "*Philco Radio 1928-1942*" by Ron Ramirez with Michael Prosise (Schiller Publishing, 1993), ISBN 0-88740-547-9.

After a few years, the old **Popular Electronics** name (Ziff Davis had closed the publication in the mid 1980s) was purchased by Gernsback, so there I was after all these years, working for **Popular Electronics** again, albeit as a Contributing Editor rather than a staff member.

Today I'm an independent consultant in the training field and in something like my thirteenth year of writing this column. Obviously I like doing it! Some of you may also know me as Editor of *The Old Timer's Bulletin*, quarterly publication of the Antique Wireless Association. Another assignment I enjoy a lot.

Under Gernsback's tolerant aegis, Antique Radio has been meandering along for years in whatever direction happens to capture my fancy at a given moment. Just now, we are in a little series about the changes that occurred in broadcast receiver design as a result of the 1930s depression. I am planning to continue with that thread here in my new **Electronics Now** home.

Bringing You Up to Date

The series began in the April issue of **Popular Electronics**, with an article titled "Scaling Down For the Depression." We discussed how the availability of the new super-sensitive pentode tubes and the growing number and power of local radio stations made it possible to develop "midget" radios that were inexpensive enough to be affordable by a cash-starved depression family.

Some of the physical and electronic design adaptations we discussed were: having the field of the electrodynamic speaker do double duty as the power-supply filter choke, developing the series string filament circuit—which paved the way for the elimination of the power transformer, stripping the decorative housings from chokes and transformers, close-spacing tuning capacitors so they could be made smaller, and supplying the speaker (mounted inside the cabinet) with the radio instead of selling it as a separate option.

The top of the radio cabinet was often rounded to accommodate the contour of the speaker it now enclosed. That, coupled with the fact that speaker grilles were often cut in intricate patterns resembling stained-glass windows, gave these radios a kind of ecclesiastical appearance. Inevitably, collectors began to refer to such sets as "cathedrals." By some kind of analogy (many churches do have churchyards, after all), the sets with tops that are squared off instead of rounded were dubbed "tombstones."

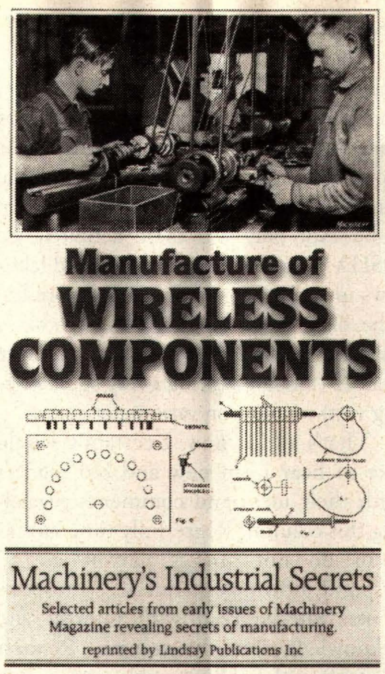
My last **Popular Electronics** column appeared the following month (May). In that column, "Those Magnificent Philco Cathedrals," we discussed Philco's unique approach to depression-era design. They downsized, all right—but not quite to the "midget" level. Philco's line of table models, which included the famous Models 20, 21, 70, and 90, while cheaper by far than the grand consoles and elaborate table models that preceded them, still retained many quality features. Some were really console radios in table model cabinets—and indeed could be purchased in console cabinets if desired.

Philco's strategy was phenomenally successful, and hundreds of thousands of those models were sold. The Model 90, with its look-alike smaller sister, the Model 70, are among the most-desired collectible sets today. Both are housed in the elegant cathedral cabinet immortalized by crack industrial designer Edward L. Combs.

Next month will bring another column on the further evolution of depression-radio designs. Following that, I'm tentatively planning a restoration or two involving some classical depression radios. As veteran readers of the column know, these restorations are not preplanned and pre-packaged. You get to look over my shoulder almost in real time as I deal with the problems that come up (and occasionally go down in flames). I never know what's going to happen as I progress with a restoration for this column, but its all part of the fun!

New Books From Lindsay

I imagine that many **Electronics Now** readers are familiar with Lindsay Publications' catalogue of "Unusual technical books, past and present, of exceptionally high quality revealing skills and secret processes almost forgotten." If you've never seen this fascinating listing of reprint books on technical subjects, write for a copy immediately. (Lindsay Publications, P.O. Box 538, Bradley, IL 60915-0538.) It is one of the biggest entertainment bargains (read that "free"!) that you will find.



Manufacture of WIRELESS COMPONENTS

Machinery's Industrial Secrets

Selected articles from early issues of Machinery Magazine revealing secrets of manufacturing.

reprinted by Lindsay Publications Inc

MANUFACTURE OF WIRELESS COMPONENTS gives today's readers insights into how radio parts were made in the 1920s. It is one of the many fascinating reprints available from Lindsay Publications.

Some of the reprints are only loosely technical in nature. In browsing through the catalogue issue included with the two books to be reviewed here, I found my eyes straying from the radio and wireless material to such offerings as "Shy Guy's Guide to Dating," and "Sex Lives of the Presidents from Washington to Clinton." A little more on the technical side is "Preserving the Dead," a late Victorian embalming manual well-illustrated with pictures of corpses sporting handlebar mustaches.

I hasten to add that the catalogue is also an important (and growing) source of the best early books on electrical and electronic communications. The two volumes recently received for review are: *Electrical Designs*—Construction Articles from *The American Electrician*, 1901 (262 pages; soft cover; $14.95 plus shipping) and *Manufacture Of Wireless Components* (1922)—Selected articles from early issues of *Machinery* Magazine (64 pages; soft cover; $6.95 plus shipping). Shipping costs (parcel post) are $1.00 for the first book ordered and 50 cents for each additional book.

Each of the 34 chapters of *Electrical Designs* is a practical construction article (taken from a 1901 issue of *The American Electrician*) for a piece of electrical apparatus. The first 15 chapters cover a variety of motors, motor generators, and rotary converters. Beginning with Chapter 16, the projects become more diverse, and include transformers, rheostats, measuring instruments, a storage battery, a dry cell, static-electricity generator, high-potential condenser, telephone instruments, and more.

These are all practical projects. If you have an eye for interpreting ancient drawings, good wood- and metal-working skills, and access to machine tools (warning: some of the heavier designs might also require foundry expertise), you could certainly have a lot of fun duplicating some of the almost century-old designs.

Manufacture of Wireless Components is also a compendium of articles about how things are made. However, the processes described are definitely not for the home workshop. The book is really targeted for plant engineers, and intended to illustrate how the radio components of the time could be manufactured on standard production machinery.

This is not information that many of us need today! Yet I found it quite engrossing to learn such things as how binding posts were made on automatic screw machines; how capacitor end plates and those little bayonet slots in tube sockets could be stamped out on punch presses; how the metal bells of speaker horns could be spun out on lathes (accomplished in stages by using wooden rod-like tools to force the work into a succession of four different polished-maple spinning chucks).

That's just the tip of the iceberg. Though the book is small, there is an unbelievable amount of production lore crammed into it. Part of its charm comes from that fact that the authors found it necessary to explain the function of the various components to radio-illiterate production folk; for example: "Horns of various types are employed for use in connection with an amplifier, the sound being delivered from the receiver of the instrument and thrown out so as to be

Accredited B.S. Degree in Computers or Electronics
by studying at Home
Grantham College of Engineering
offers 3 distance education programs:

- B.S.E.T. emphasis in Electronics
- B.S.E.T. emphasis in Computers
- B.S. in Computer Science

NEW -Electronics Workbench Professional 5.0 included in our B.S.E.T curriculums
-Approved by more than 200 Companies, VA and Dantes, (tuition assistance avail.)

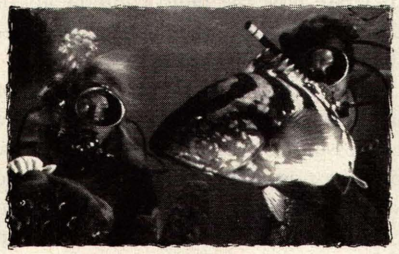
For your free catalog of our programs dial
1-800-955-2527
http://www.grantham.edu

GCE
Your first step to help yourself better your future!

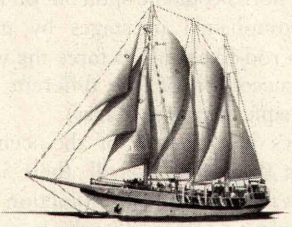
DETC

Grantham College of Engineering
34641 Grantham College Road
Slidell, LA 70460-6815

Some Say Watching Tropical Fish Lowers Blood Pressure & Relieves Stress...



They Could Be On To Something.



Discover the Caribbean aboard a Tall Ship.
6 & 13 day adventures from $650.
For more information call your travel agent or 1-800-327-2601.

Windjammer Barefoot Cruises LTD.
P.O. Box 190120, Dept. 5569, Miami Beach, FL 33119

CIRCLE 132 ON FREE INFORMATION CARD

heard without the use of head-phones."

Those with current plant experience will view, with fascination and horror, scenes like the one showing a capacitor plate operator at work with hands inches from the unprotected jaws of his large punch press and no safety interlocks in sight. Not only was there definitely no OSHA presence then, but the child labor laws must have been quite a bit more lax. The back cover of this reprint shows a round-cheeked lad who looks no more than 12 (though wearing a very adult looking vest) working on variometer rotors.

That's all for now. I certainly would like to hear from new and old readers with their ideas and comments regarding this column! Regretfully time limitations do not always permit me to respond individually. But all correspondence will be read with interest and acknowledged in the column. Request for technical assistance, schematics, etc. will be referred to the readers of the column in special "mailbag" editions published from time to time.

I'm also interested in hearing about your restorations and collecting activities—and be sure to include pictures! These, too, will appear in the occasional "mailbag" columns.

You can contact me at "Antique Radio," c/o **Electronics Now**, 500 Bi-County Blvd., Farmingdale, NY 11735. I'm also reachable through my personal e-mail address: ellis@interacces.com. EN

Q & A

continued from page 5

hobbyist to build this at home? — D. H., Columbia City, IN

A The advertisement that you enclosed describes a $679.99 charger for 12-volt car batteries. It says, "Pulse charger revives batteries you think are dead and useless... Ferro-resonant pulse technology eliminates sulfation, extends battery life and increases battery efficiency."

It's a product of PulseTech (*http://www.pulsetech.com*). How well it works, we can't say. It has been known for some time that an aging rechargeable battery will often benefit from brief charging at a higher than normal rate, or charging from pulsating DC, or both.

The $680 price tag does make us a bit wary. The charger could surely be built for considerably less—if you knew what to build, and if you could do it without violating PulseTech's patents.

Writing to Q&A

As always, we welcome your questions. The most interesting ones are answered in print. Please be sure to include plenty of background information (we'll shorten your letter for publication) and give your full name and address (we'll only print your initials). *If you are asking about a circuit, please include a complete diagram.* Due to the volume of mail, we regret that we cannot give personal replies. Questions can be sent to Q&A, Electronics Now Magazine, 500 Bi-County Blvd. Farmingdale, NY 11735. They can also be e-mailed to Q&A@gernsback.com, but please do not expect an immediate reply and please don't send graphics files larger than 100K. EN

COMPUTER CONNECTIONS

continued from page 9

off), has only a CD-ROM (no floppy drive), and possesses limited expandability options.

The latter, was a single—gasp!—USB port. As the only way to connect, well, anything to the machine, that USB port got a lot of vendor support real fast. The *only* version of a peripheral that iMac users could buy had to be a USB version. Consider that over 800,000 iMacs were sold, and you'll quickly figure out why the small computer helped USB in a big way.

What about all those iMac owners who have old Apple peripherals sitting around going to waste? Good news. CompuCable has released iDock, a new six-port hub that lets an iMac interface with both USB and non-USB devices.

Your iMac's one port will transform into two Apple serial ports, one parallel port, and three extra USB ports if you add an iDock to your system. It's got the same "Bondi-Blue" color as the iMac, and even functions as an adjustable monitor stand. The iDock retails for $199.

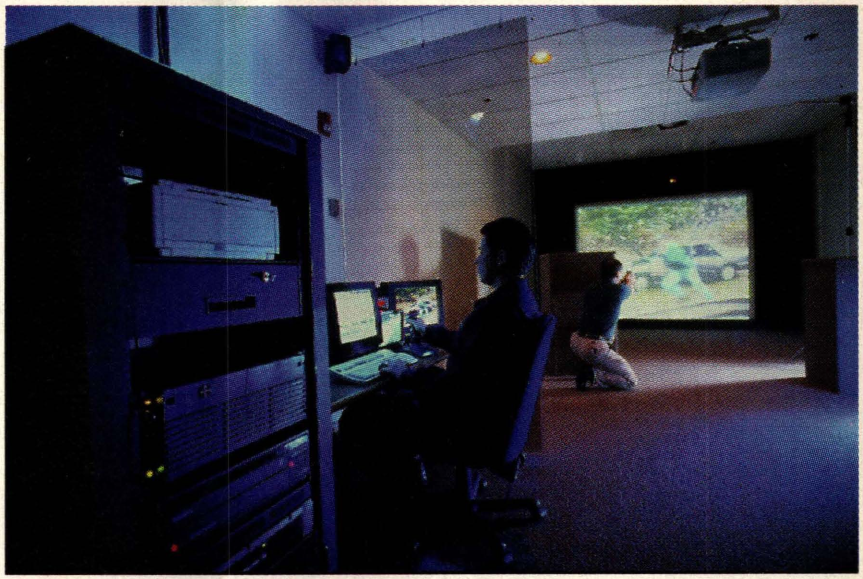
That about wraps it up for this month. If you'd like to get in touch you can send e-mail to connections@gernsback.com, or snail-mail to *Computer Connections*, **Electronics Now**, 500 Bi-County Blvd., Farmingdale, NY 11735. EN

Prototype

A Simulator That Shoots Back

The police officer approaches the suspected drug dealer. Suddenly, the "perp" pulls out a handgun and fires. The officer is hit. Fortunately, he only experiences a bee-sting-like feeling near his heart. That is because this fire-fight happened in Advanced Interactive Systems' Professional Range Instruction Simulator (PRISim) However, the officer gained some valuable experience that could save his life once he gets back on the dangerous streets.

AIS says PRISim offers the most realistic use-of-force training simulator available today. For one thing, just like on the street, the "bad guys" in the PRISim simulations shoot back using its exclusive ShootBack cannon, which safely fires 0.68-caliber nylon projectiles.



THE PRISim SIMULATOR includes a 10 × 10 ft projection screen and sophisticated computer control to simulate real police "use-of-force" situations.

Another feature of PRISim that adds further realism is the use of untethered real firearms modified to fire "safe" AirMunition non-lethal rounds. A "live-fire" capability is also available as an option. Unlike laser-based weapons-training simulators, which are often video game-like, weapons used in PRISim simulation operate just like in real life. They fully recoil and eject shells. Trainees perform magazine changes, tactical reloads and even experience malfunctions all under the stressful conditions of a realistic tactical simulation. The reusable AirMunition can be used with no special environmental requirements and are extremely cost effective. With untethered weapons, trainees have the mobility to take cover, draw, and fire exactly in the way they would in a real world situation. Using a joy stick, the instructor can aim and fire the projectiles in either semi-automatic three-round bursts or in a full-automatic mode whenever appropriate during the scenario. Traveling at a speed of around 88 mph, if they hit a trainee they give immediate, but perfectly safe feedback when mistakes are made.

PRISim Configuration

PRISim is Windows 95-based so it can be updated with plug-and-play software and hardware to prevent obsolescence. The system consists of computer hardware, software, sensor system, and a 10-foot by 10-foot projection screen that allows the reusable compressed air bullets to be tracked in real-time. Capabilities include online scenario control, automated performance assessment, and trainee history recording and call-up.

The user-friendly interface and intuitive controls enable the instructor to concentrate on the training—not on operating the simulator. The trainer can tailor the situation, control the level of conflict, and change training "on the fly" so the simulations react to actions taken by the trainee. At the conclusion of training, the instructor can recreate any stage in the scenario to debrief the trainee. That includes where the bullets hit the screen and where the trainee made mistakes.

Realism Saves Lives

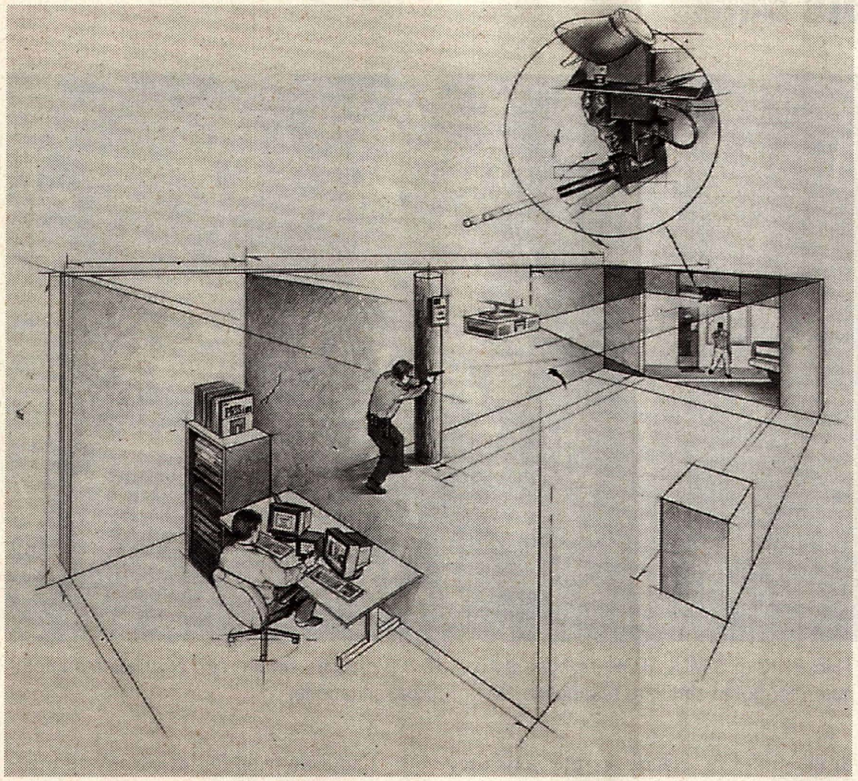
According to instructors who have used PRISim, trainees experience the same levels of stress, heartbeat, respiration, and blood pressure as in a real hot-fire situation. Stress is the officer's worst enemy in life-threatening situations because it distorts time perception and clouds judgment. Adrenaline levels can skyrocket to where it negatively impacts

FOR MORE INFORMATION

Advanced Interactive System
565 Andover Park West
Suite 201
Tukwila, WA 98188-3321
Web: www.ais-sim.com

the ability to effectively fire a firearm. The amount of force need to squeeze the trigger is misjudged, which can be responsible for accidental firearm discharges.

After being hit by a ShootBack projectile, officers quickly understand the results of not taking cover quickly enough or not positioning themselves properly. Many trainees have commented that this single aspect of the PRISim system is a true life saver when anticipating and encountering similar situations on the street. Through use of more advanced scenarios with multi-level branching to change outcomes to match action taken, firearm realism, and the ShootBack cannon, stress levels match or closely approximate the actual situation. Veteran officers who have been in actual gunfights say that what happens in PRISim scenarios is exactly like what happens in the field. As one officer stated, the only difference with PRISim is "you go home if you make a mistake."



A TYPICAL SETUP for the PRISim Training Simulator. The "ShootBack" cannon (in inset) gives the users effective feedback to help them understand what the consequences of a mistake under real-life circumstances could be.

All this capability does not come cheaply. Depending on the configuration and options ordered, prices range from $65,000 to $95,000. However, smaller law enforcement agencies can train their officers via a mobile simulator program offered by AIS. Featuring PRISim including the ShootBack capability, the mobile version uses a 36-foot long, 14.5-foot wide (when fully opened), and 12-foot high trailer. The mobile training system is staffed by a team of former police officers headed by an ex-L.A.P.D. SWAT officer.

Simulators for Sportsmen

AIS products are not only for training law enforcement officers. Its TrueFire Simulator Systems are found at commercial gun ranges around the country. Again, there are computer-generated targets and laserdisc-based videos to shoot at with real weapons or replica pellet guns. The system allows several people to shoot at the same scene, and laserdisc-based video story lines and games add to the realism, and fun. There are also firearms education videos to increase skill levels and safety.

TrueFire uses an Intel Pentium computer system, a printer for score sheets, projector and screen, surround sound speakers, laserdisc player, computer cart, and Windows 95-based software.

TechnoHunt is the industry standard for interactive archery. Installed at hundreds of ranges throughout the U.S., TechnoHunt offers MultiShot, a unique feature allowing three archers to fire simultaneously. By attaching a special tip, archers can use their own bows and arrows. A large number of high-quality scenes are available for target practice and realistic bowhunting of animals from deer and elk to geese and turkeys. The simulations include realistic environment factors like the wind, and obstacles like branches or shrubs. The system tracks an arrow in flight and reports arrow speed. A True Yardage feature—where yardage pins are attached to the bow—allows archers to realistically shoot animals up to 60 yards away from a 20-yard shooting line. Three-dimensional hit zones are anatomically correct and move with the animals—they're not just static shapes.—**By Bill Siuru** PT

Hazards Ahead

The nation's highways could become safer and more efficient within the next few years as more motorists and public agencies begin using a commercially available traffic-hazard warning system developed at Georgia Tech.

The Safety Warning System (SWS), a microwave-based communications system, gives motorists a 25-30 second warning of hazardous traffic and highway conditions ahead. Messages are delivered via automated mobile or fixed-site transmitters and received by either advanced in-vehicle receivers or older model radar detectors in individual vehicles.

SWS alerts drivers to real-time hazards, dangerous weather, and other traffic conditions with an audible alarm, one of 64 pre-programmed text messages shown to drivers on an LED display, and/or synthesized voice message. There are five categories of messages in the system: warnings for highway construction or maintenance zones, weather-related hazard messages, highway-hazard advisories, travel and convenience information, and fast-/slow-moving vehicle warnings.

Available on the market since 1996, SWS is now being refined and field test-

RESEARCHER GENE GRENEKER is refining and field testing a device he developed called SWS, a microwave-based communications system that warns motorists of hazardous driving conditions ahead.

ed by SWS inventor and senior research engineer Gene Greneker of the Georgia Tech Research Institute. New capabilities under study may allow traffic managers to transmit specific details on traffic problems just ahead.

The three-year study, which started in October 1998, is being funded by a $2.1 million grant from the U.S. Department of Transportation (DOT). Greneker will use his grant to conduct extensive field tests of SWS fixed-site and mobile-unit transmitters. He also plans to investigate the feasibility of adding variable text messages to SWS fixed-site transmitters. That would also allow public safety and highway officials to program the transmitters with specific messages.

Greneker is collaborating with Dr. John Leonard, assistant professor of civil engineering, in conducting a one-year SWS fixed-site transmitter test in Atlanta. It will involve as many as 500 participants and be the largest scale test to date. "We will also be testing the SWS transmitter mounted on police cars," Greneker says. "We want to see how durable and reliable the signal strength is under a variety of conditions."

The other part of the DOT-funded study will add modems and thus variable text messaging capability to fixed-site SWS transmitters. A two-way modem link between the transmitter and an Advanced Traffic Management Center could deliver a traffic manager's alternate route messages to motorists in urban areas. In rural areas, fixed-site transmitters could be equipped with microprocessors and smart software. The system would collect radar-derived speed data to determine the speed of traffic, analyze it, and decide if a traffic advisory message should be sent to motorists.

SWS is part of more than four million advanced radar detectors in use in the United States today, and its signals can be picked up by about 15 million older model detectors, as well. Current models sell for $200, but manufacturers (BEL-Tronics, Santeca, Uniden, and Whistler) are developing an SWS-only model for about $100.

SWS L.C., the organization licensing the technology, has placed SWS transmitters in 26 states, with school buses, trains, police departments, and departments of transportation. PT

Spallation

Los Alamos National Laboratory will build a half-mile long linear accelerator for the Spallation Neutron Source (SNS), a $1.3 billion facility that will produce the most intense pulsed neutron beam in the world. The facility, which will be located at Oak Ridge National Laboratory in Tennessee, is a collaborative project involving five Department of Energy national laboratories—Lawrence Berkeley, Brookhaven, Argonne, Los Alamos, and Oak Ridge. When operational, it will be used for a

➤ Motorola Masters Multimedia Management

At the recently concluded Consumer Electronics Show, Motorola unveiled "Streamaster"—its open, extensible, multimedia architecture aimed at revolutionizing video entertainment and video communications. The Streamaster architecture is defined by a Motorola-owned and -developed operating environment that supports interactive 3D graphics, Java, MPEG digital video, high-fidelity audio, Internet access, electronic commerce, and broadband networking in a single integrated unit.

Motorola will be developing a family of standard "Intelligent Broadband Access" and "Intelligent Internet Access" products based upon the Streamaster architecture. The company previously announced the Blackbird Home Media Platform, the first Streamaster-compliant technology product.

The Streamaster architecture is based upon a foundation of the Microware OS/9000 operating system running David 2.2 and Maui, a HTML engine based upon Spyglass' Device Mosaic 3.0, pJAVA, the Nuon Media Libraries for advanced graphics and media handling, and Motorola-developed network extensions.

Says Brad Hale, Marketing Director, Motorola's Media Processing and Platforms Division. "During the last few months we have developed a formal brand name and brand identification for our multimedia processing technology. Streamaster is descriptive of our architecture and solutions in a variety of areas. We provide solutions to enable 'streaming' video, 'streaming' data, 'streaming' communications, 'streaming' gaming. The unique characteristics of our architecture create solutions that can control the flow of this stream into the home, office, or workplace. Streamaster will designate platforms that are compatible with our defined and evolving operating environment, which includes the OS9000 Application Programming Interface (APIs), pJAVA. HTML and our network extensions."

By combining the long-standing strengths of its PowerPC CPU and communications capabilities with the Nuon Technology, Motorola has created what is believed to be the industry's first practical "soft" set-top box. Powered by an independently programmable CPU and by communications and multimedia engines, the platform is able to quickly change its role from one function to another to suit the consumer or to adapt to new and emerging requirements. PT wide range of materials-research and neutron-scattering experiments.

Roger Pynn, director of the Los Alamos Neutron Scattering Center (LANSCE), said the Laboratory would also build control and diagnostic systems to handle the beam. Los Alamos is expected to receive about $30 million in funding for the project during the current fiscal year and about $350 million over the seven-year life of the design and construction phases, he added.

Spallation is a term used to describe the reaction that occurs when a high-energy particle bombards an atomic nucleus, ejecting some of its neutrons. When aimed at a sample, some of these neutrons will interact with the nuclei and bounce away at an angle. This phenomenon, called neutron scattering, can provide detailed information about the structure, motion, and atomic interaction of a wide range of materials that cannot be learned in any other way.

The SNS will have an ion source that produces negative hydrogen ions, accelerates them to 2.5 million electron volts, and delivers them to the linear accelerator or linac. The linac will accelerate the hydrogen ions to one-billion electron volts and transfer them to an accumulator ring, where they will be bunched and intensified for delivery onto a mercury target to produce the pulsed neutron beam, which is then aimed at the target samples.

When completed in 2005, the SNS will provide users from federal laboratories, universities, and private industry with a powerful new tool to study the properties of materials ranging from liquids to plastics to composites to metals. Neutron scattering research has already been valuable in the development of such products as small electric motors, plastics, lubricants, jet aircraft, and high-temperature superconductors. PT

Antennas, Anyone?

The Consumer Electronics Manufacturers Association (CEMA) launched its TV Antenna Selector Map Program. Using color-coded maps that match antenna performance, CEMA's new program will help consumers select the appropriate type of antenna for their television reception location.

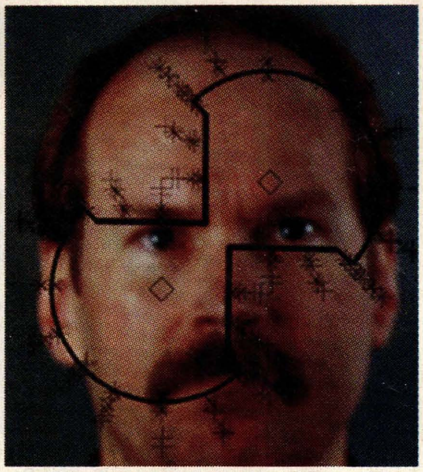
"Millions of consumers use antennas to receive free over-the-air television signal, and the need for antennas is greatly increasing," said CEMA President Gary Shapiro. "As consumers continue to embrace digital satellite TV systems, such as the Digital Broadcast System (DBS), they are turning to antennas to receive local off-air signals. Additionally, antennas may be the only way for consumers to receive the sensational picture quality and digital surround sound of a high-definition television (HDTV) signal until the local cable system passes through HDTV signals."

The antenna selector maps, which have been developed for all 211 designated market areas (DMAs), calculate reception from all full-powered TV stations in a city, including terrain and building obstruction and likely interference. Consumers can identify the location of their homes on the map, finding in which "color" they reside and then consult the antenna selector guide. It explains which types of antennas are most useful and also lists the models available for the area. Following voluntary antenna performance specification standards, participating antenna manufacturers will include a stylized CEMA logo with color labels on product packaging that accurately match the guide and the maps, making proper product selection a snap.

Companies participating in the mapping program include Channel Master, Helios Antenna Systems/HDTV Group, Recoton Corp., Sony Electronics, Tandy Corp., Terk Technologies Corp., Thomson Consumer Electronics, and Zenith Electronics Corp. The National Association of Broadcasters (NAB) and the Satellite Broadcasting Communications Association (SBCA) provided technical assistance. Retailers can learn more about the program from their antenna manufacturers or from the Web site: www.CEMAcity.org. Map kits can be ordered from the Shipyard, 2710 NE Summer St., Minneapolis, MN 55413; Fax: 612-676-0080; e-mail: mail@theshipyard.com PT

Pattern Recognition

A sophisticated new data-classification scheme is being incorporated into the design of Sandia National Laboratories' hand-held "lab-on-a-chip" chemical sensor system. The classification method is based on human perception rather than mathematical equations—in other words, on the human ability to visually group real-world objects seen near each other.



PHYSICIST GORDON OSBOURN, developer of VERI, looks through the dumbbell shape that humans subconsciously use to group data points.

"In the area of visual perception, no computer has ever matched a biological system—for example, a dog's or a two-year-old's," according to the technique's principal developer, Sandia physicist Gordon Osbourn.

Osbourn says the program is based on people's tendency to group objects by superimposing over any two points an invisible shape that resembles a dumbbell. The subconscious mind sizes the dumbbell so that each bell centers on a point. If no other point intrudes in the space, one considers the two points a group, he adds.

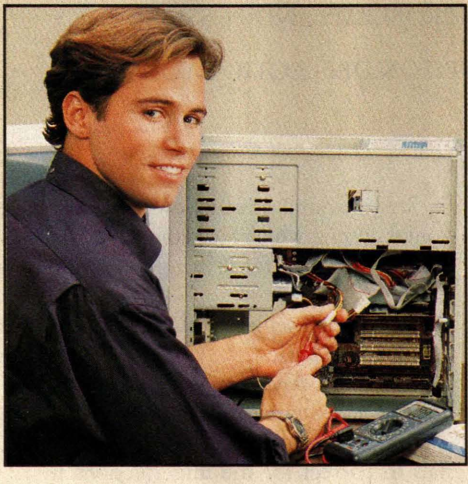
But while biological visual systems are limited to analyzing two-dimensional plots or 3-D patterns, Osbourn's system offers the opportunity to "see" in many "dimensions," in effect cross-analyzing patterns among many data sets. The same empirical judgments made by human eyes are made by a computer program to judge the closeness among the points of many groups of data. The relations between data may be too complex for a human to see, but the same empirical process used in human decision-making is followed in the computer program.

Because the technique is based on observing how people empirically group objects they see, it is called VERI, for Visual-Empirical Region of Influence. PT

Command top dollar with A+ certification.
Complete in less than 9 months!

Now NRI gives you a fast, low-cost way to become a Certified PC Technician

To qualify for today's top PC servicing jobs, you need know-how, hands-on experience, and A+ certification, the mark of a true professional. *Now NRI gives you a fast, easy way to earn those qualifications — even if you've never serviced computers before!*



Master every subject covered on the A+ exam!

NRI's new Certified PC Technician course starts you off right away with the knowledge you need to succeed in PC servicing today. You go right to the heart of PC hardware and peripherals, first mastering their operation so that you'll be able to quickly identify core problems and execute effective repairs.

You go on to examine specific procedures and techniques for troubleshooting and servicing computers and common peripheral devices, including disk drives, monitors, printers, and Local Area Networks (LANs). But that's not all...

Course includes ForeFront diagnostics plus NRI's own A+ exam prep on CD-ROM

NRI knows that you learn better when you learn by doing. That's why you train hands-on with The Troubleshooter®, professional diagnostic software from ForeFront. This self-booting software tests memory, IDE drives, monitors and video cards, the CPU and coprocessors, and even multimedia devices such as CD-ROM drives and sound cards.

You ultimately train with NRI's exclusive CD-ROM that features sample tests, insider tips, and helpful explanations — everything you need to take the A + exam with confidence. You also receive authoritative texts explaining each of the topics covered on the A + exam.

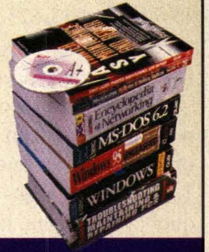
Only NRI gives you the knowledge, hands-on skills, and test-taking strategies you need to go for coveted A + certification — and pass on your first try!

Enhanced online instructor support!

Although you train at home, at your own pace, you never have to go it alone. NRI's experienced instructors are always available to answer your questions, provide supplemental information, and keep your motivation high. And now, you can reach your instructors via phone, mail, fax, or online through NRI's newly redesigned Web site.

What's more, you'll be able to communicate with your instructors, fellow students, and industry experts through NRI's exciting new chatroom facility. No school gives you more!

Find out more today — FREE information!



Discover why more than one and a half million people have chosen NRI as their stepping stone to a new career, job advancement, or a money-making business of their own. Request free information by calling our toll-free number, visiting our Web site, or completing the coupon below.

Course requires Pentium or compatible computer system with Windows 95/98, CD-ROM drive, 20 meg of free hard drive space, and Internet access.

A + Certification Program is an industry-wide, vendor-neutral program developed and sponsored by The Computing Technology Industry Association.

Act now – and get a fast start on a profitable new career as a Certified PC Technician!

1-800-321-4634, Ext. 31

NRI Schools
4401 Connecticut Avenue, NW
Washington, DC 20008

www.nrischools.com

☑ **CHECK ONE FAST TRACK COURSE ONLY**

☐ **CERTIFIED PC TECHNICIAN**
☐ Visual Basic Programming
☐ C++ Programming
☐ Office 97
☐ Computer-Based Accounting
☐ A+ Certification (test prep only)

Name ______________________ Age ________
Street ______________________ Apt. # ________
City ______________ State ______ Zip ________

A Division of The McGraw-Hill Companies

Accredited Member, Distance Education and Training Council 4530-0599

BY SAM GOLDWASSER
SERVICE EDITOR

Display Symptoms, and More

WE CONTINUE THIS MONTH WITH SOME SPECIFIC DEFLECTION-RELATED PROBLEMS AND POSSIBLE CAUSES. WE WILL CONCLUDE WITH INFO ON DEFLECTION YOKE TESTING AND REPAIR.

Deflection Summary

The electron beams in the CRT need to be scanned horizontally and vertically in a very precise manner to produce a raster—and a picture. For NTSC and PAL, the horizontal scan rates are 15,734 and 15,625 Hz, respectively; the vertical scan rates are 60 and 50 Hz (approximately), respectively.

For PCs and workstation monitors, a wide range of scan rates are used. Some of the common ones are shown in Table 1. Even in high-resolution fixed-frequency monitors, those high horizontal-scan (in particular) rates necessitate some fancy circuit design. All components are running under stressful conditions, and it is amazing that failures are not more common.

With auto-scan monitors, the complexity of the circuits increases dramatically to accommodate the wide range of horizontal scan rates. Relays or electronic switches are used to select power-supply voltages, tuning components, and to make adjustments in the deflection circuits to handle DOS VGA one minute and Autocad 1280 × 1024 the next. It comes as no surprise that the most stressful time for a monitor may be when switching scan rates.

The deflection circuits must have the following characteristics:

1. Sync processor to provide separate H and V pulses to the deflection system.
2. Horizontal oscillator that locks to the horizontal sync pulses.
3. Horizontal drive followed by horizontal output, which feeds the deflection yoke (and flyback for HV and other voltages).
4. Vertical oscillator that locks to the vertical sync pulses.
5. Vertical drive/output that feeds the vertical deflection yoke.
6. Various additional deflection signals to correct for the imperfections in the geometry of large angle deflection CRTs.
7. Auto-scan deflection control and selection circuitry (auto-scan monitors only), probably controlled by a microprocessor that stores scan parameters for each scan rate and automatically detects the appropriate settings to use by analyzing the input video. Relays are often used for that selection since they are easy to control and can handle the voltages and currents in the various deflection circuits reliably.

Next, let's look at some common problems and their likely causes and solutions. To help you identify the symptom, some of the most common ones are shown in Fig. 1.

Monitor Display Is Off-Center

These sorts of problems usually relate to the picture shifting when switching between applications or between DOS and Windows. First, make sure you are using the correct monitor settings and video drivers.

If you have a setup program for your video card, make sure you are running well within the accepted scan rates for each resolution, and then toggle sync polarity and adjust H position or phase and see what these do.

Also make sure your cables are secure. While a bad connection would likely have messed things up worse, it won't hurt to check.

Size Or Position Problems At Certain Scan Rates

Here we are talking about large, noticeable problems. First, make sure you are not specifying an incorrect scan rate for your monitor. Check your video card setup and/or monitor selection in Windows.

Assuming you are not violating the scan-rate specifications but have a picture that is twice the height of the screen

TABLE 1—MONITOR SCAN RATES

Standard	Horizontal (kHz)	Vertical (Hz)
MDA	18.43	50
CGA	15.75	60
EGA	15.75-21.85	60
VGA	31.4	60-70
SVGA (800 × 600)	35-40	50-75+
SVGA (1024 × 768)	43-52+	43-75+
SVGA (1280 × 1024)	64-72+	60-75+
Workstations	64-102+	60-76+

and one half the width, for example, this could indicate a failure in the scan-rate switching circuitry of an auto-scan monitor. Either the logic is faulty and ordering the wrong selections for power-supply voltage and tuning components or the relays or other relevant parts are faulty. This could be due to bad connections as well—quite likely in fact. Also, try to reset the afflicted parameters using the digital controls (if your monitor has them) and then confirm that your video card is putting out the correct scan rate (try another monitor or examine the video signals with an oscilloscope).

Try prodding the circuit boards with an insulated stick—that could help identify bad connections or unstick a sticky relay.

If nothing helps, a schematic will likely be needed to proceed further with these sorts of problems.

Reduced Width

Older monitors often did not allow a full-screen display at certain resolutions. There may be underscan modes/switches as well. Keep in mind that advertising a large diagonal CRT does not necessarily imply that you can fill it!

However, if this problem just happened with no changes to your computer system (video card, scan rates, operating system), or are very severe (like ⅓ the width of the screen), then the following are possibilities:

- The B+ to the horizontal output is lower than normal.
- There could be problems in the scan rate switching circuitry.
- There might be a bad (low value or high ESR) decoupling capacitor.
- An open yoke winding (though this is less likely).

Damage Caused By Incorrect Or Missing Video

Mostly, there are problems at scan rates which exceed the monitor's specifications (low or high). However, too low a scan rate, an absent or corrupted signal input, or just a particular combination of events can blow some poorly designed monitors.

The specification that is likely to be more critical is the horizontal rate as it probably puts more stress on the components than the vertical rate. Attempting to determine the monitor's limits by experimentation can be very risky—it will be much too late when you find out. If the manual says 75 Hz V and 64 kHz H, stay below **both** of those specifications. If you exceed the safe ratings and the design isn't really good, there is the possibility of blowing components in the horizontal-deflection and high-voltage sections, which will result in expensive repair bills.

Note that you will likely get no warning of impending failure. In addition, even if the monitor does not immediately turn into a pile of smoking silicon and plastic, components may be under more stress and running at higher levels of power dissipation, so total failure could be just around the corner. More subtle degradation in performance could occur over time as well.

Most people won't see the difference beyond 75 Hz anyhow, and your programs may run slightly faster at lower scan rates because the video adapter will be using less memory bandwidth to refresh the screen.

Horizontal Deflection Shutting Down

Confirm that the horizontal deflection is shutting down along with the high voltage if it is derived from horizontal deflection. Listen for the high-pitched deflection whine (NTSC/PAL/CGA), test for static on the screen, see if the CRT filaments are lit, and turn up the brightness and/or screen control to see if you can get a raster. Some possibilities:

- Power is failing to the horizontal output transistor—this could be due to a low-voltage power-supply problem, bad connection, etc.
- Base drive to the horizontal-output transistor is failing—could be a fault in the horizontal oscillator or bad connection.
- Problem with the flyback transformer or its secondary loads (flyback may provide other power voltages).
- X-ray protection is activating—either due to excess HV or due to a fault in the X-ray protection circuitry.

If the problem comes and goes erratically, it could be a bad connection, especially if whacking the unit has an effect. If the problem comes and goes periodically, then a component could be heating up and failing, then cooling, etc.

Monitor Non-Linearity

Most modern monitors are nearly perfect with respect to linearity. There are almost never any user adjustments and there may not even be any internal adjustments. A sudden change in linearity or a monitor that requires a warm-up period before linearity becomes acceptable may have a bad component—probably a capacitor in the horizontal-deflection circuits. In that case, try some cold spray or a heat gun to see if you can locate the bad part.

Vertical Squashed

Before attacking the circuitry, make sure your vertical scan rate is within the monitor's capabilities and that the user vertical-size control is adjusted properly. If there is no distortion, this is likely as many (but not all) circuit problems would result in non-linearity or cutoff of the top or bottom portions of the picture. All you may need to do is change your computer's video settings! Swap the monitor or computer to be sure it is not a problem with the video card.

However, if failure happened suddenly and the vertical is squashed at all scan rates, this is likely a vertical deflection problem—possibly a bad capacitor, bad connection, bad flyback/pump-up diode, or other component. None of these should be very expensive to replace (in a relative sort of way).

If the symptoms change—particularly if they become less severe—as the unit warms up, a dried out electrolytic capacitor is most likely to blame. If the symptoms get worse, the cause could be a bad semiconductor.

A defective deflection yoke is also possible or in rare cases, a bad yoke damping resistor (e.g., 500 ohms, may be mounted on the yoke assembly itself).

Keystone-Shaped Picture

This means that the size of the picture is not constant from top to bottom (width changes) or left to right (height changes). Note that some slight amount of keystoning is probably just within the manufacturing tolerance of the deflection yoke and factory set up. With a monitor, such defects are more noticeable than with a TV since much of the display is of rectangular boxes—*i.e.*, windows, lines of text, graphics, etc. Furthermore, the monitor is usually run just barely underscanned to maximize the viewing area without cutting anything off. Any deviations from perfection show up in relation to the CRT bezel. However, a sudden increase in the keystone effect could indicate a probler with the deflection yoke.

An open or short in a winding (o

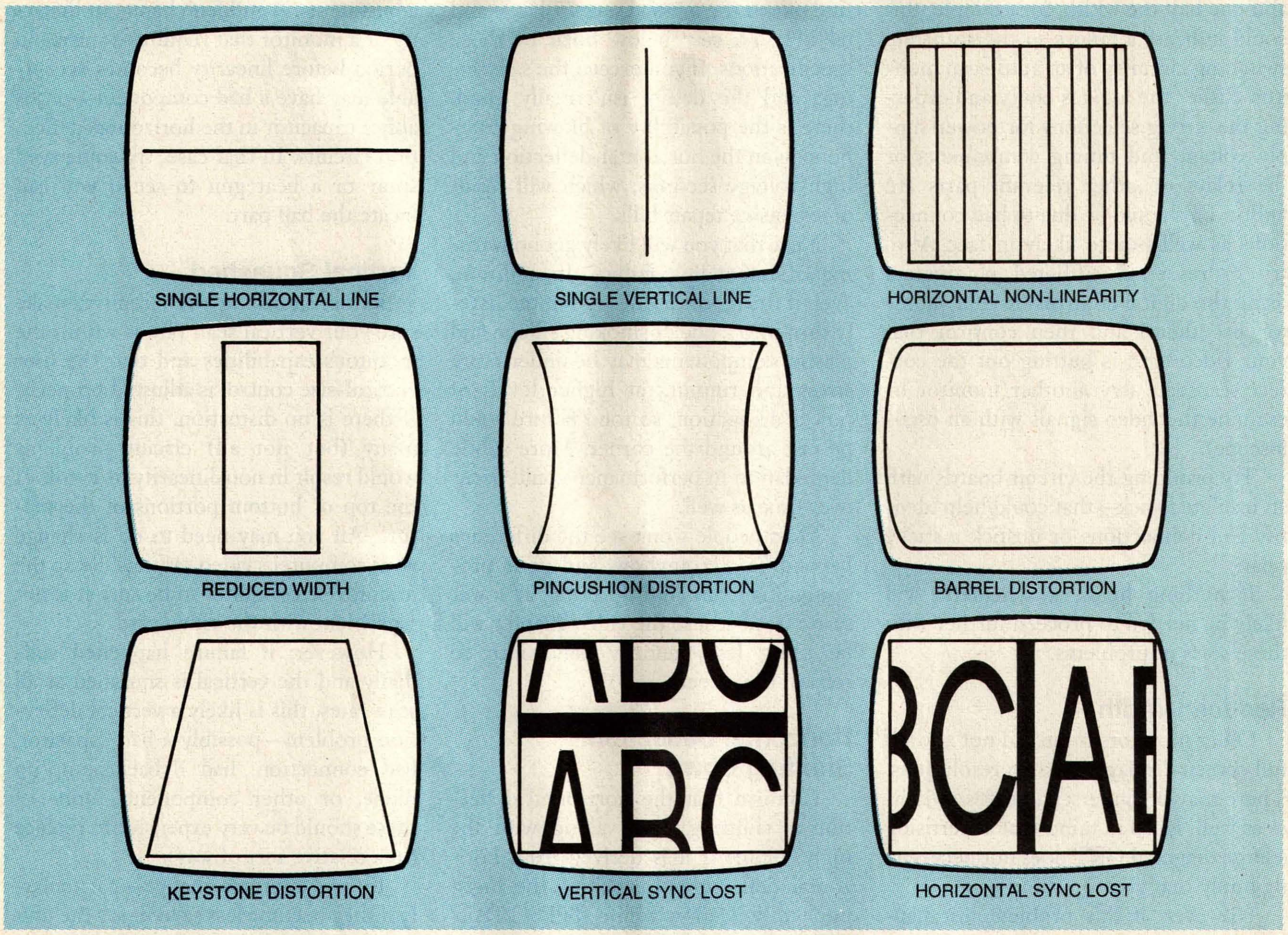


FIG. 1—PROBLEMS IN THE DEFLECTION CIRCUITS can present many different symptoms. Here are how some of the most common symptoms look.

associated components mounted on the yoke assembly) will result in the beam being deflected less strongly on the side where that winding is located. However, with a high-scan-rate monitor, there may be many individual windings connected in parallel in the yoke so the effect of only one opening up may not be as dramatic as with a TV where there may only be a single pair of windings for the horizontal and another for the vertical.

A simple test of the yoke in this case can be performed by swapping the connections to the yoke for the affected direction (*i.e.*, if the width changes from top to bottom, interchange the connections to the vertical windings). If the keystone shape remains the same (but of course the picture flips), it is likely the yoke. If the keystone shape flips, it is a circuit problem.

Monitor Will Not Sync

There are a wide variety of causes for a monitor that will not display a stable or properly configured image. First, check that the cable connections are correct and secure. If those are fine, we need to look at the specific symptoms. Among them are:

- Lack of horizontal sync—picture drifts smoothly horizontally: This may mean that the horizontal sync signal is missing due to a bent, pushed in, or broken connector pin; another bad connection; or a fault in the sync-processing circuitry. Note that depending on the difference between the video horizontal rate and the free-run frequency of the horizontal oscillator, the picture may be torn left or right or have multiple images superimposed horizontally—the diagram in Fig. 1 is the special case where they are virtually the same.
- Incorrect horizontal lock—torn picture (like a TV with the horizontal hold control misadjusted—if you remember those): This means that the sync signal is reaching the monitor but that it is having problem locking to it. Check the rate specifications—you may be exceeding them.
- Lack of vertical sync—picture rolls smoothly vertically: This may mean that the vertical sync signal is missing due to a bent, pushed in, or broken connector pin; another bad connection; or a fault in the sync-processing circuitry.
- Unstable vertical lock—picture jumps or vibrates vertically: This symptom could be due to scan-rate problems or a fault in the vertical-sync circuitry of the monitor.
- Multiple or repeated images (horizontally or vertically): There may be multiple images side-by-side, on top of each other, or interleaved. The most likely cause is driving the monitor with an incorrect scan rate. However, faulty circuitry could also be to blame if you see this symptom.

Bright Or Dark Bars

These are on the horizontal or vertical edge of the picture, and may be sharp-edged or blurry. The latter could result when a portion of the active video is unblanked during retrace.

Where the entire picture is present, the video blanking is not occurring properly beyond the picture boundary.

Where part of the picture is cut off with a bright horizontal or vertical line at that point, it is either a video timing problem or a fault in the deflection circuitry preventing the beam from being where it is supposed to scan in enough time. You may be seeing part of the active video during retrace or as the beam reverses direction at the start or end of retrace. Horizontal timing problems would produce vertical bars on the right or left edge; vertical timing problems would produce horizontal bars at the top or bottom edge.

If your video card permits control of video timing parameters, try reducing the relevant active time relative to the blanking period. The relevant software settings might be horizontal position, phase, size, and sync polarity. If that does not help, your video card may be incompatible with the monitor.

If the problem just happened without any changes to the video source, the monitor may have a problem. Those could be in the:

- Deflection circuits: coil or capacitor, a power-supply fault, position or size settings or control, or deflection yoke.
- Video amplifier or drive (CRT neck board), or blanking circuits: chip decoupling capacitors or filter capacitors in scan-derived power supplies. If the bars are significantly colored—not just shades of gray—then a video problem is likely.

Single Vertical Or Horizontal Line

CAUTION: To prevent damage to the CRT phosphors, immediately turn down the brightness so the line is just barely visible. If the user controls do not have enough range, you will have to locate and adjust the master brightness or screen/G2 pots.

Since you have high voltage, the horizontal deflection circuits are almost certainly working (unless there is a separate high-voltage power supply—almost unheard of in modern TVs but possible in some higher performance monitors).

Check for bad solder connections between the main board and the deflection yoke. Could also be a bad horizontal coil in the yoke, linearity coil, etc. There is not that much to go bad based on these symptoms assuming the high voltage and the horizontal deflection use the same flyback. It is almost certainly not an IC or transistor that is bad.

A single horizontal line means that you have lost vertical deflection. High voltage is most likely fine since there is something on the screen.

This could be due to:

1. Dirty service switch contacts. Flip the switch back and forth a couple of times. If there is some change, then replace, clean, resolder, or even bypass it as appropriate.
2. Bad connection to deflection yoke or other parts in vertical output circuit.
3. Bad vertical deflection IC or transistor.
4. Other bad parts in vertical deflection circuit, though there are not that many parts that would kill the deflection entirely.
5. Loss of power to vertical deflection circuits. Check for blown fusible resistors/fuses and bad connections.
6. Loss of vertical oscillator or vertical drive signals.

The most likely possibilities are in the deflection output stage or bad connections to the yoke.

Intermittent Picture Jumping Or Jittering

This has all the classic symptoms of a loose connection internal to the TV or monitor, probably where the deflection yoke plugs into the main PC board or at the base of the flyback transformer. Gently whack the monitor and see if that has any effect.

It could also be a component momentarily breaking down in the power supply or deflection circuits.

Another possibility is that there is arcing or corona as a result of humid weather. That could trigger the power supply to shut down perhaps with a squeak, but there would probably be additional symptoms including partial loss of brightness or focus before it shuts down. You may also hear a sizzling sound accompanied by noise or snow in the picture, static in the sound, and/or a smell of ozone.

If your AC power fluctuates, an inexpensive monitor may not be sufficiently well regulated and may pass the fluctuations on as jitter. The video card is unlikely to be the cause of this jitter unless it correlates with computer (software) activity.

Vertical Foldover

This means that the picture is squashed vertically and a part of it may be flipped over and distorted. That symptom indicates a fault in the vertical-output circuit. If the TV or monitor uses an IC for that, then the chip could be bad. It could also be a bad capacitor or other component in this circuit.

To troubleshoot, test components in the vertical-output stage or substitute components with known good ones.

Barrel/Pincushion Distortion

Perfectly straight sides is not the natural state of affairs with linear-scan waveforms unless correction is applied. Normally, a signal from the vertical deflection that looks something like a rectified sinewave is used to modify width based on vertical position. There is usually a control to adjust the magnitude of this signal and often also its phase. So with excess (barrel distortion) or reduced (pincushion distortion) width, it would seem that this correction circuit has ceased to function.

If you have the schematics, check them for "pincushion" adjustments and check signals and voltages. If you don't have the schematics, try to find the "pincushion" magnitude and phase adjustments on the board and look for bad parts or bad connections in the general area.

If controls are present, then tracing the circuitry might be possible without a schematic. With luck, you have a bad part that is either open or shorted, and that can be easily found with an ohmmeter.

However, with modern digital setup adjustments, it is even tougher to diagnose problems. That's because the digital adjustments control a D/A converter that is located somewhere else and is linked via a microprocessor.

Deflection-Yoke Testing

A faulty deflection yoke can affect the geometry (size and shape) of the raster, result in insufficient high voltage and/or other auxiliary power problems, and blow various components in the low-voltage power supply or elsewhere.

Where high voltage (and other flyback-derived voltages) are reduced and other problems have been ruled out, unplugging the deflection yoke (assuming no interlock) may reveal whether it is likely at fault. If this results in some kind of improvement, a defective yoke is quite possible.

CAUTION: powering a TV or monitor with a disconnected yoke must be done with care for several reasons:

- The CRT electron beam(s) will no
be deflected. If it turns out that the yo
is the problem, this may result in a
bright spot in the center of the

(which will turn into a very dark permanent spot quite quickly). Therefore, disconnecting only the winding that is suspect is better. Make sure the brightness and/or G2 (screen) is turned way down or disconnect the CRT filament if you don't need to see a picture.

- Removing the yoke (which is effectively in parallel with the flyback) increases the inductance and the peak flyback voltage on the HOT. In the extreme, this may blow the HOT if run at full line voltage/normal B+. It is better to perform these tests using a Variac at reduced line voltage if possible.
- The deflection system will be detuned since the yoke inductance plays a very significant role in setting the resonance point in most designs. Don't expect to see totally normal behavior with respect to high voltage. However, it should be much better than with the faulty yoke.

If possible, compare all measurements with a known good identical deflection yoke. Of course, if you have one, swapping is the fastest and surest test of all! In many cases, even a not-quite identical yoke will be close enough to provide useful information for testing. However, it must be from a similar piece of equipment with similar specifications (size and scan range). Don't expect a color TV yoke to work in a high performance SVGA monitor!

Note: the substitute yoke doesn't have to be mounted on the CRT which would disturb purity and convergence adjustments but see the caution above about an undeflected beam

Once it is determined that the yoke is defective, we need to troubleshoot it to learn more about the nature of the defect and to see if it can be easily repaired.

The deflection yoke consists of the horizontal coils and vertical coils (wound on a ferrite core), and mounting structure. Little magnets or rubber/ferrite strips may be glued in strategic locations. DO NOT disturb them! In rare instances, there may be additional coils or other components mounted on the same assembly. The following deals only with the actual deflection coils themselves—the other components (if any) can be tested in a similar manner.

The horizontal section consists of an even number of windings hooked up in parallel/interleaved with half of the windings on each of the two ferrite core pieces. The horizontal windings will be oriented with the coil's axis vertical and mounted on the inside of the yoke (against the CRT neck/funnel). They may be wound with thicker wire than that used for the vertical windings.

The first step in troubleshooting is to do a resistance check. That might be possible without removing the yoke from the CRT if the terminal block is accessible. Disconnect the individual windings from each other and determine if the resistances are nearly equal. Check for shorts between windings and between the horizontal and vertical windings as well. Typical resistance of the intact windings (at the yoke connector assuming no other components): TV or NTSC/PAL monitor: a few ohms (3 ohms typical); SVGA monitor: less than an ohm (.5 ohms typical).

Next, perform a visual inspection. Look for charring or other evidence of insulation breakdown due to arcing or overheating. For the horizontal windings, this will require removing the yoke from the CRT since little if any of the windings are visible from the outside.

You also can perform a ring test. We will be discussing this with respect to the testing of flyback transformers in a future Service Clinic article.

The vertical section of the yoke is usually manufactured as a pair of windings wired in parallel (or maybe in series), though for high vertical-scan-rate monitors, multiple parallel/interleaved windings are also possible. The vertical windings will be oriented with the coil's axis horizontal and wound on the outside of the yoke. The wire used for the vertical windings may be thinner than that used for the horizontal windings.

As before, do a resistance check. That might be possible without removing the yoke from the CRT if the terminal block is accessible. Disconnect the individual windings from each other and determine if their resistances are nearly equal. Check for shorts between windings and between the horizontal and vertical windings as well. The typical resistance of the intact windings (at the yoke connector assuming no other components): TV or NTSC/PAL monitor: more than 10 ohms (15 ohms typical); SVGA monitor: at least a few ohms (5 ohms typical). Also perform a visual inspection: look for charring or other evidence of insulation breakdown due to arcing or overheating.

While a ring test could be done on the vertical windings as well, since they have significant resistance and very low Q, it may be of limited value.

Deflection-Yoke Repair

So you found a big black charred area in/on one of the yoke windings. What can be done? Is it possible to repair it? What about using it for testing to confirm that there are no other problems before ordering a new yoke?

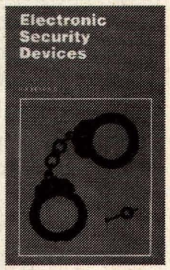
If the damage is minor—only a few wires are involved, it may be possible to separate them from each other and the rest of the winding, thoroughly clean the area, and then insulate the wires with high temperature varnish. Then, check the resistances of each of the parallel/interleaved windings to make sure that you caught all the damage.

Simple plastic electrical tape can probably be used as insulation for testing purposes—it has worked for me—but would not likely survive very long as a permanent repair due to the possible high temperatures involved. A new yoke will almost certainly be needed.

Wrap Up

That's it for now. Next time we will continue our discussion of monitor troubleshooting and repair. Until then, check out my Web site, www.repairfaq.org. I welcome comments (via e-mail only please to sam@stdavids.picker.com) of all types and will reply promptly to requests for information. See you next time! EN

BUY BONDS



ELECTRONIC SECURITY DEVICES

A great book for project builders. It is quite common to associate the term "Security Devices" with burglar alarms of various types. However in fact it can refer to any piece of equipment that helps to protect people or property. The text is divided into three basic sections: Chapter 1 covers switch-activated burglar alarms and includes exit and entry delays. Chapter 2 discusses other types of burglar alarms and includes Infra-Red, Ultrasonic and Doppler-Shift Systems. Chapter 3 covers other types of security devices such as Smoke and Gas Detectors; Water, Temperature and Baby Alarms; Doorphones, etc. Most circuits are simple, and stripboard layouts are provided.

To order Book BP56 and send $5.99 includes shipping and handling in the U.S. and Canada only to **Electronics Technology Today Inc.**, P.O. Box 240, Massapequa Park, NY 11762-0240. Payment in U.S. funds by U.S. Bank check or International Money Order. Please allow 6-8 weeks for delivery.

LETTERS

SEND YOUR COMMENTS TO THE EDITORS OF ELECTRONICS NOW MAGAZINE

Wrong Web Address

There was an error in the Web address for Philips ECG in the "New Literature" column (**Electronics Now**, March 1999). The correct address is www.ecgproducts.com.—*Editor*

McTube Correction

It has come to our attention that there was an error in the schematic diagram for "The Real McTube" that appeared on page 32 (**Electronics Now**, February 1999). The labeling for pins 6 and 8 of the vacuum tube (V1) were reversed. Please note that the table that appeared in the article on page 35 is correct.—*Editor*

Hard-To-Get Part

Some readers have had problems obtaining the 3-pole 6-position rotary switch mentioned in my article, "Build the Q-Sort" (**Electronics Now**, February 1999). Ideally a 3-pole 6-position switch should be used; however, the 4-pole 6-position switch (Mouser Electronics part number 10WR046) listed on page 36 of the article is a perfectly acceptable substitute. One of the poles and its associated connections are simply not used.

LARRY BALL

Sorting Out the Q-Sort

I was very interested in the simplicity of the Q-Sort project, "Build the Q-Sort" (**Electronics Now**, February 1999). Upon investigating its operation, it would appear that a few errors have crept in. In the Sources of Material sidebar on page 36, reference is made to a four-position, six pole switch. Shouldn't that have been listed as a six-position, four-pole switch?

On page 39, the upper diagram shows test clip colors from left to right, as black, green, and red, which is logical. The lower diagram shows black, red, and green which appears to be an error.

Also, there is a mix-up in the wiring and/or labeling of switch S2. The picture on page 36 shows the position of S2. The article states the most CCW position of the switch is position one when viewed from the front. When that convention is used to follow the diagrams on page 39, the positions will be as follows: EBC, ECB, BCE, BEC, CEB, and CBE.

Thanks for a great magazine. I enjoy reading it every month!

DOUGLAS M. CRAWFORD
North York, Ontario, Canada

Battery Not Included

There were some errors in the parts list in my article, "Surface-Mount Shortwave Radio" (**Electronics Now**, March 1999). Along with the parts listed, the complete kit of parts also includes a headset and a printed circuit board for the $24.95 price; you do not have to order a board separately. However, the board is available by itself for those needing just the board alone.

The kit does not come with either a case or a 9-volt battery.

PAUL E. YOST

Improved McTube

As Mr. Nachbaur says in "The Real McTube" (**Electronics Now**, February 1999), there has been a surge of interest in recent years in tube amplifiers for guitars and other instruments. Nearly half of the guitar amplifiers in a typical music store are part-tube or all-tube! Some of the part-tube amps contain a single 12AX7 in a circuit similar to "The Real McTube," with the rest of the amp solid state. (Add-on units similar to "The Real McTube" are also sold.) Other part-tube amps are solid state except for tubes in the power-output stage. (Some musicians prefer the sound of output tubes over the sound of output transistors.)

In the parts list for "The Real McTube," T1 and T2 are listed with a current rating of 1.5 A. This is larger than needed and will increase the size, weight, and cost of the project. Also transformers supplying a current much less than their rated output tend to have increased output voltage, which will shorten the life of the 12AX7. For T1 a 0.6-A or 1.0-A rating is sufficient, and for T2, the smallest rating available is more than needed. (From the voltages in Table 1 and the values of R4, R5, R6, and R7, the total B+ current is less than one mA, and the total current in the 6.3-volt winding of T2 could not be more than 50mA.)

BILL STILES
Hillsboro, MO

Safety Hazard

In the article, "Build A Surface-Mount Shortwave Radio," on page 43 the author describes using plastic glue under hand-soldered SMD components. This is a safety hazard. I was once nearly blinded when plastic glue vaporized during soldering and shot out into my eye.

In our lab, we use Grobet #5 (thermal) tweezers to position the component while tacking down the first pin with solder. If you feel that you must use glue, please also use safety goggles during construction and any future rework!

STEVE RABIN
San Diego, CA

Write To:
Letters,
Electronics Now Magazine,
500 Bi-County Blvd.,
Farmingdale, NY 11735

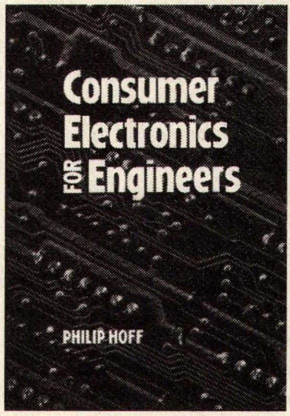
Due to the volume of mail we receive, not all letters can be answered personally. All letters are subject to editing for clarity and length.

NEW LITERATURE

USE THE FREE INFORMATION CARD FOR FAST RESPONSE

Consumer Electronics for Engineers

by Philip Hoff
Cambridge University Press
40 West 20th Street
New York, NY 10011-4211
Tel: 800-872-7423
Web: www.cup.org
$44.95



CIRCLE 338 ON FREE INFORMATION CARD

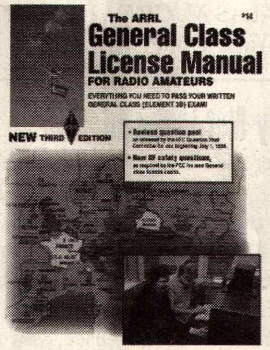
Have you ever wondered how an FM radio or a television actually works? Even in an electrical-engineering course, everyday products like these are not given detailed treatment. This is the first book of its kind to explain clearly the operating principles of "real-world" electronic devices, including video recorders, compact disc players, and mobile phones.

An ideal textbook for electrical engineering students and for practicing engineers, the book contains over 350 illustrations and many exercises. Each chapter begins with a brief historical overview of the device concerned. The key principles of the device's operation are then described, and a block circuit diagram is presented. Next, these "real-world" circuits are analyzed in detail. This approach integrates the many different aspects to the subject material of an electrical engineer's course work, from physical optics to digital signal processing.

BooksNow To order books in this magazine or, any book in print. Please call anytime day or night: **(800) BOOKS-NOW (266-5766)** or (801) 261-1187 ask for ext. 1454 or visit on the web at **http://www.BooksNow.com/electronicsnow.htm.**
Free catalogs are *not* available.

The ARRL General Class License Manual: 3rd Edition

from American Radio Relay League
225 Main Street
Newington, CT 06111
Tel: 800-243-7767
Fax: 860-594-0303
Web: www.arrl.org
$14



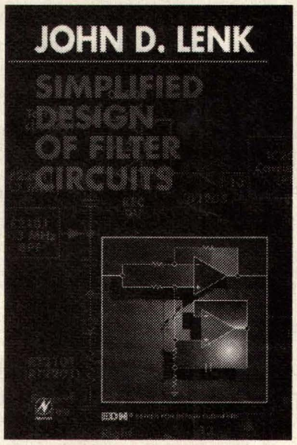
CIRCLE 339 ON FREE INFORMATION CARD

Containing clear explanations of the theory for every question, this book prepares readers for the Element 3B (General Class) license exam. At the beginning of each chapter, there is a list of key words that appear in the chapter along with a simple definition for each word or phrase. Included in this edition is the revised question pool released for use beginning July 1, 1998, new RF safety questions as required by the FCC for General class license exams, and a new chapter to explain the RF safety material and help ensure that your station complies with the new FCC RF environmental exposure regulations.

All the FCC rules you'll need to know for the exam are included, along with clear explanations. There is also an updated "Setting Up Your Station" chapter to help you get on the air as quickly and as easily as possible after you have passed the exam.

Simplified Design of Filter Circuits

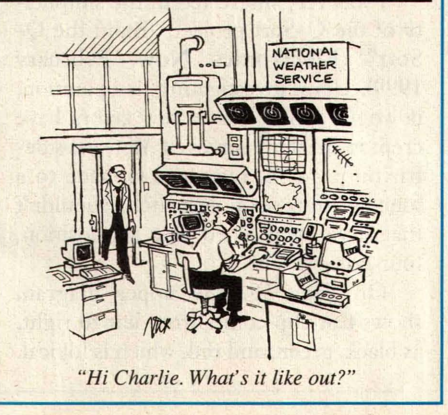
by John D. Lenk
Newnes, an imprint of Butterworth-Heinemann
225 Wildwood Avenue
Woburn, MA 01801-2041
Tel: 800-366-2665 or 781-904-2500
Fax: 800-446-6250
e-mail: orders@bhusa.com
Web: www.bh.com/newnes
$29.95



CIRCLE 340 ON FREE INFORMATION CARD

This is a step-by-step guide to designing filters using off-the-shelf ICs. It starts with the basic operating principles of filters and common applications. The author then goes on to describe how to design circuits using chips available on the market today.

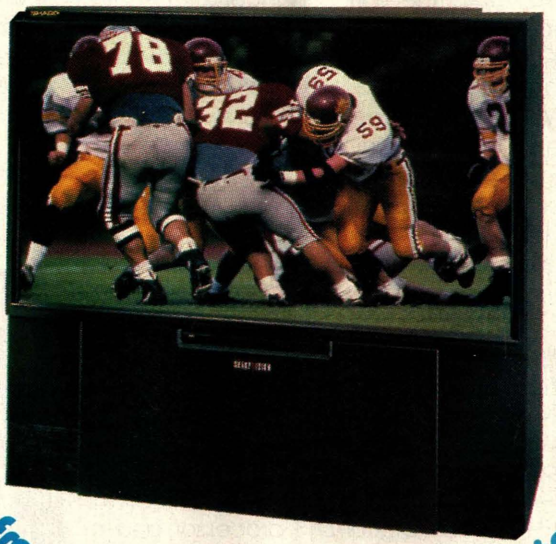
The emphasis is on practical, simplified approaches to solving design problems. Each chapter comes with numerous illustrations. EN



"Hi Charlie. What's it like out?"

Digital Vegas

News from the 1999 Consumer Electronics Show



CARL LARON
EDITOR
ELECTRONICS NOW

More than a few pundits (myself included) have commented on the fact that the Consumer Electronics Show could not be held in a more fitting place than Las Vegas. That's because, in a sense, the hundreds of companies that exhibit there are betting large parts of their corporate bankroll that they have guessed right on a new technology or an emerging consumer trend. Sometimes they win big; sometimes they crap out.

This year's CES was no different, except that perhaps the industry has moved up to a bigger money game. We are of course referring to the wholesale move from analog-based technology to digital. This of course all started long before the last show. The 1998 CES was literally an all digital event. If a company's products did not somehow include the word digital in it, it was essentially ignored.

But the move to digital technology continues to be a painful one, especially when it comes to DTV. Digital broadcasting finally made its debut this past fall, but if you missed it, you are not alone. Most areas still have no access to digital broadcasts, and very few sets are in the hands of consumers.

But we are getting ahead of ourselves. Let's look at some of the highlights of the show. Believe it or not, there were some products and technologies that got even this jaded writer a little excited.

The consumer electronics industry is betting on a digital future, and there's no better place than Las Vegas to make that large a wager.

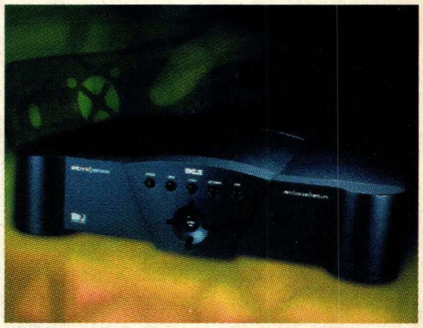
DTV, Naturally. First things first. As was the case last year, DTV was the 3000-pound gorilla of the show. The only difference was that last year's vaporware was this year's real product—more or less.

The problem is that nearly all existing or soon to ship DTV products are expensive. An integrated HDTV set will set you back between $8000 and $10,000. Further, very little digital programming is currently available. The result is that very few DTV products have been sold, and there does not seem to be a building demand—at least not yet.

So, then, why did virtually every TV manufacturer make DTV the centerpiece of their display? That's because there is optimism that by the time the next CES rolls around, things will be markedly different.

For one thing, digital broadcasts will be more available as more markets come on line to meet the FCC-mandated timetable, and a major new source of programming will be available. We are talking about direct broadcast satellite. Both DSS and Echostar (Dish Network) have announced that they will carry HBO's new HD service. Further, DirecTV has announced the availability of HD pay-per-view movies beginning late this spring.

And to bring that programming to the masses, Thomson has announced a breakthrough product to help consumers make the transition to digital broadcasts. That product, the RCA DTC100, is combination DSS/over-the-air DTV converter box. It receives both standard and HD DSS broadcasts and terrestrial DTV broadcasts and displays them on a standard analog TV set. While the resulting image will not be HDTV, it will offer improved picture quality over standard TV. If connected to a high resolution monitor (via the converter's SVGA output), HD-quality video can be viewed. Suggested retail is $649, with availability in the first half of 1999.



THE RCA DTC100 combination DSS/over-the-air DTV converter box.

Note that while the price point on the Thomson box is considerably lower than other DTV solutions, it does not provide a way to view HDTV images on a HD-ready TV. However, even the most expensive current set-top boxes do not provide a digital link to such a set. That's because copy protection issues remain under discussion. We covered this a bit in last month's editorial and will not rehash things here except to note that most expect a standard of some type to be negotiated by the time the next CES rolls around.

DVD Everywhere. DVD is not new, but it is an evolving product. As evidence of that, new DVD applications and technologies could be seen nearly everywhere you looked at the show.

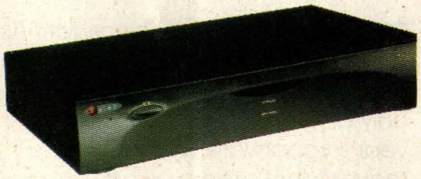
The quality of the picture produced by a DVD player is limited by many factors, but the prime one is the quality of the display device it is used with. Since TVs and monitors in the U.S. follow the NTSC standard, including an interlaced display, that's the format of the video output from DVD players. But it does not have to be.

Because HD display devices will become increasingly more available over the coming years, it seems logical to provide a way for DVD discs and players to take full advantage of those displays, and prototype units that could do just that were exhibited by several manufacturers. One example was the Toshiba SD5109. It delivers a 480p (480-line progressive scan; one of the DTV standard resolutions) video signal to any display device capable of handling that resolution. It will have a suggested retail price of $799.

Unfortunately, due to the same copy protection issues as DTV, availability is very much up in the air for this and similar units from other manufacturers.

OK, so it will be a while for this one, but what can you get right now? Well how about a DVD player that will never become obsolete? Impossible, you say? Well, you are right, but there is a new Philips unit that comes close. Their DVD 825 offers an upgrade path that allows users to add new features and capabilities as they become available. To do so, a user simply inserts a special DVD into their player. That disc contains programming that the unit can incorporate into itself to update such things as search, speed, audio control, video control, and playback options (no, it can't add progressive-scan output). The unit also offers a parental-control feature that prevents children from viewing unauthorized discs. The unit will retail for $349.

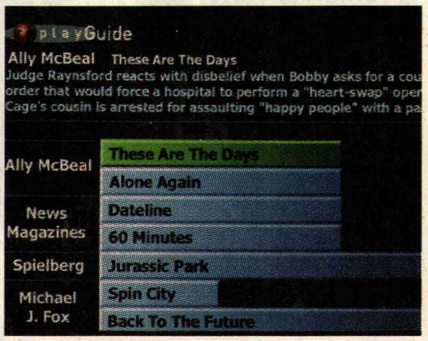
How about DVD on the go? Well, Panasonic's CX-DV1500 is designed for in car use. The player itself installs in the car dash, and a 7-inch screen that can be installed between the front seats, in an overhead panel, or anywhere else that is appropriate, provides the display. Connect the unit to an optional Dolby Digital/DTS processor and a four-speaker automotive sound system for a full surround-sound experience. For the ultimate car-theater experience, there's even a subwoofer output. Whether you want to hear car chases, police sirens, explosions, and the like while driving at highway speeds is up to you. For portable DVD viewing at more sedate speeds, Panasonic offers hand-held portable DVD players such as the DVD-L10.



THE REPLAYTV set-top box from Replay Networks.

Most consumers think of DVD as a video medium. However, as computer users with DVD-ROM drives know, the key to its strength is that it can hold vast amounts of data. Well, in a consumer application, what do you get if you devote the storage abilities of a DVD to audio? The obvious answer is a DVD with a heck of a lot of audio on it, and that is true. But you can also get audiophile-quality, high-resolution recordings; multi-channel recordings; and additional features such as photos or video, liner notes, and even interactivity. One example of the last would be to embed Internet links in the material that would take someone to a Web site to see the latest concert and other information for the disc's artist. DVD-audio (or DVD-A) is essentially ready to go, but there are still copy-protection issues (what a surprise!) to be resolved.

Play it Again. Picture this: You have purchased a pay-per-view movie. Halfway through, the telephone rings. Because of your situation (perhaps you are a doctor on call or you have your own business and clients call you at home all the time), you feel you must interrupt your evening and pick up the phone. By the time you complete the call and return to the TV set, enough of the film has passed to make watching the rest of it pointless, or at least not as much fun.



Ally McBeal These Are The Days

Judge Raynsford reacts with disbelief when Bobby asks for a cou
order that would force a hospital to perform a "heart-swap" oper
Cage's cousin is arrested for assaulting "happy people" with a pa

Ally McBeal	These Are The Days Alone Again
News Magazines	Dateline 60 Minutes
Spielberg	Jurassic Park
Michael J. Fox	Spin City Back To The Future

WITH REPLAYTV you can set up specialized channels to record programs by name or type, or to search listings for a favorite actor or actress and record all movies and programs with that individual.

Now imagine the same scenario. Only this time, when the telephone rings you just press a button on a remote control. The movie pauses (in real time). When you come back to the set, you just hit the button again and pick up where you left off. Neat, huh?

Well, judging from the crowd and buzz around two booths at CES, a lot of the attendees thought so, too. The companies were Tivo and Replay Networks, and their similar systems (Tivo and ReplayTV) generated quite a bit of excitement.

OK, what exactly are we dealing with here? Well, at the heart of both units is a high-speed, high-capacity disk drive that records the incoming TV signal. That's how the scenario outlined at the beginning of this section was possible. Multi-tasking logic allows information to be recorded and played back at the same time so, for example, you can begin watching the beginning of a program while it is still being recorded, or even decide you want to record a program well after you have started watching it. For sports fans, that also means you have the ability to watch the replays you want to see, and in slow motion if you want, then pick up the game action in progress or from where you stopped it to watch your replays.

Wait, there is more. Both units have the ability to search out all cable, satellite, and over-the-air TV channels available to you and pull together specialized channels and viewing suggestions based on your criteria. With a press of a button, you can have the system record all of the episodes of a particular show. The Tivo unit also keeps track of your viewing preferences and makes suggestions about other programs that might interest you. The ReplayTV unit allows you to set up specialized channels to record programs by name or to search listings for a favorite actor or actress and record all movies and programs with that individual.

Both units allow you to output recorded material to a VCR for long term storage and viewing.

What about video quality? It depends on the amount of compression. Both boxes use MPEG2 compression, with the compression set by the user. Based on my observations, at the higher compression levels the video does show noticeable digital artifacts, though if VHS video quality does not bother you, these might not disturb you much either. At low compression, video is quite good—approaching DVD levels according to both companies. The compression trade-off is, of course, recording time—low compression reduces storage time dramatically.

What about price? The Tivo system starts at $500 for the hardware (10 hour maximum recording time), plus $10/month or $100/yr for the programming service. The ReplayTV boxes sell for $699 (6 hours max.), $999 (14 hours max.), and $1499 (28 hours max.). There is no charge for the programming service.

Home Networks. One consequence of the explosive growth of the Internet is that computer access has become a bone of contention in many homes. One solution is multiple PCs and multiple telephone lines. But in many cases that is not desirable. A better solution would be to give multiple PCs a way to share a single line, and while you are at it to share information, peripherals, etc.

Of course what we are talking about here is a computer network. But while a traditional wired network is fine for an office environment, it can be a bit much to tackle for a homeowner. That's why a number of manufacturers and industry groups had on display wireless home-network products.

Among them, one that made a large splash was Philips Ambi. That "Best of Show" device took the home-network concept even a step further by providing the functionality of a two computer network, but eliminating the need for a second computer.

Instead, the second computer desktop is a standard TV. In the words of Philips "Ambi uses advanced concurrent technology to create multiple desktops." That means that while one user is surfing the Net, working on a spreadsheet, or writing a letter on the primary computer, someone else could be surfing the Net or playing PC games using a large-screen TV in the living room or den. Both users would have full, concurrent access to peripherals such as printers or scanners, and both would have independent access to the Internet using a single line. Ambi uses display-enhancement technology to ensure that the display on the TV will look good at normal viewing distances. The range for the system is around 150 feet. Ambi will be available in the first half of 1999 at a price between $500 and $700.

THE PHILIPS AMBI provides the functionality of a two computer network, but eliminates the need for a second computer. It uses a chip set developed by ShareWave.

The Ambi system uses a chip set developed by ShareWave and is part of their ShareWave Digital Wireless technology. Among the aspects of that technology are a set of network protocols; a wavelet compression technology that allows, among other things, the transmission of high-bandwidth information such as full motion video over links with limited throughput; and an RF transmission system based on direct-sequence spread spectrum. ShareWave envisions their technology as the centerpiece of a comprehensive home network that will allow other digital devices such as DVD players, TV sets, PDAs, and the like to share data.

INFOACCESS FROM INNOMEDIA allows consumers to set up a simple, wireless, two-computer network.

Ambi was not the only home-network solution shown. The HomeRF Working Group had a booth promoting their SWAP (shared wireless access protocol) specification. Among the things that SWAP hopes to make possible are wireless home networks to interconnect and share data between PCs, PC peripherals, PC-enhanced cordless phones, and other similar devices. While no products using the specification were shown, the HomeRF Working Group members list is impressive, and includes such companies as IBM, Ericsson, Honeywell, Intel, Microsoft, Mitsubishi, Motorola, National Semiconductors, Philips, Samsung, Sharp, and many, many more.

Another home-network product on display was InfoAccess, from InnoMedia. That $199 system allows consumers to set up a simple, wireless, two-computer network. One computer is designated the host computer and provides printer, modem, and Internet-access resources. The second computer then is given access to all of the host's resources. Both computers have full and independent access to all resources, including Internet access. Communications between the two computers is via direct-access digital spread spectrum. Perhaps best of all for many consumers, the interface to the PC is via its serial port, which means nothing has to be installed inside the PC itself.

THE QUICKTIONARY reading pen from Seiko Instruments.

Neat Stuff. As with every CES, everyone is out to convince you that their product is unique, etc., even though you've just seen the same or a similar device three booths back. Still, there is a lot at the show that was indeed different enough to bear mentioning in this space.

Seiko Instruments had on display their Quicktionary reading pen. That hand-held scanner is designed to provide "assistive technology" to those whose reading skills are limited. When the reading head is passed over a word in text, the word is shown in large letters on the display and the unit "speaks" the word out load via the built-in speaker or earphones. With a push of a button, the user can also view the words definition. Seiko also displayed a translation pen that could read text in one language (German, for example), and display that word's English translation.

Interest in digital photography is growing at an explosive rate despite some significant limitations that are inherent in that technology. One problem is that, while the captured images are ideal for display on the Internet or on a computer or TV monitor, getting photographic-quality hard copy is a little more problematic. The most popular solution is ink jet printers, but while sometimes very good results can be obtained by using special inks and papers, in the end they are still ink-jet images. Now, however, there are some alternatives. For example, Polaroid had on display their new PhotoMAX digital photo printer. That $299 device takes the output from any personal computer and outputs the images onto standard Polaroid Spectra or 600 film. We'll be looking at the Polaroid printer, as well as some other digital-print solutions in a future issue of **Electronics Now.**

By now, many of you have heard of DiSSTance cordless telephones. Those use 900-MHz spread-spectrum technology, which at one time was classified by the military, to give cordless phones increased range and privacy. How much increased range? Well, according to a spokesperson for Conexant (formerly Rockwell Semiconductor Systems), the maker of the chip set used in these phones, up to 5 miles with an absolutely clear line of sight. In normal suburban environments the range is much less, but is still impressive at about a normal block or two. Phones using the Conexant chip set were on display in a number of booths.

THE POLAROID PHOTOMAX digital photo printer takes the output from any personal computer and outputs the images onto standard Polaroid Spectra or 600 film.

Business people and others on the go often need up-to-date information, yet rarely have the time to get it from traditional sources such as newspapers, business journals, etc. The MobilePlayer Plus from Audible.com fills that need. It allows the user to download up to 7 hours of high-quality spoken audio from the Internet for later playback. Among the content providers are *The Wall Street Journal, The Harvard Business Review, The Economist,* and more. Also available are audiobook titles from some of the top unabridged audiobook publishers, audio magazines, and on-demand radio services such as *Car Talk* and *Nightly Business Report.* The audio can be heard via headphones or through a car radio via a built-in RF link. The player costs $199, and content is available by subscription for radio programs and audio publications, and on a per book basis for audiobooks.

THIS RCA CA-1000 RECEIVER is the hardware portion of a new audio-on-demand service. Programming is provided by Command Audio.

Thomson and Command Audio also announced an audio product designed to help those on-the-go to get news, entertainment, and other information on an on-demand basis. Their system, called, naturally enough, Audio On-Demand, pairs the RCA CA-1000

CONTACT INFORMATION

Audible, Inc
65 Willowbrook Blvd.
Wayne, NJ 07470

Command Audio
101 Redwood Shores Pkwy.
Redwood City, CA 94065

Conexant
4311 Jamboree Road
Newport Beach, CA 92660

DirecTV
2230 East Imperial Hwy.
El Segundo, CA 90245

Echostar
5701 Santa Fe Dr.
Littleton, CO 80120

HomeRF Working Group
404 Balboa Street
San Francisco, CA 94118

InnoMedia
4800 Great America Pkwy.
Suite 400
Santa Clara, CA 95054

Panasonic Consumer Electronics
One Panasonic Way
Secaucus, NJ 07094

Philips
64 Perimeter Center East
Atlanta, GA 30346

Polaroid
549 Technology Square
Cambridge, MA 02139

Principle Solutions
3708 Lehman Ct.
Rogers, AR 72758

Replay Networks
1003 Elwell Ct.
Palo Alto, CA 94303

ShareWave, Inc
5175 Hillsdale Circle
El Dorado Hill, CA 95762

Seiko Instruments
Consumer Products Division
2990 W. Lomita Blvd.
Torrance, CA 90505

Thomson Consumer Electronics
10330 North Meridian St.
Indianapolis, IN 46290

Tivo
894 Ross Dr.
Sunnyvale, CA 94089

Toshiba America
9740 Irvine Blvd.
Irvine, CA 90803

Wink Communications
1001 Marina Village Parkway
Alameda, CA 94501

receiver with Command Audio's subscription-based radio service. It allows consumers to select what they want to hear, and when they want to hear it. No computer or Internet connection is needed. Program material will be available from providers such as National Public Radio, *Sports Illustrated, People Magazine*, and ABC News. In addition, they can get personalized, up-to-date information such as traffic reports, the latest headlines, stock quotes, and more. The receiver is set to retail for $199; the service will cost $15/month. The service will debut in 10 markets this year, and nationwide in 2000.

I don't know how many of you have seen the film *Starship Troopers*, but one of the plot gimmicks in the movie was a series of propaganda-like clips displayed on the sets of the citizens of that future world. One feature of those sets was the ability to click on a "Want to know more?" or other icon to get additional information, related items, and other programming.

Well, the future is here, or at least around the corner in the form of Wink-enhanced broadcasts and Wink-capable TV sets and set-top cable and satellite boxes. A number of Wink-enhanced products, such as a line of new TV sets from Toshiba were announced at the show, as was an agreement with DirecTV to carry Wink-enhanced content.

In the Wink system, information is passed down to the TV or box via the blanking interval in analog signals or in the digital data stream in satellite or DTV transmissions. The viewer is then alerted to the presence of that additional information by way of a small icon. Then, if desired, the viewer can access that information via a press of a button on a remote control. Among the networks providing Wink-enhanced content are NBC, Turner (CNN, The Weather Channel, etc.), MTV Networks, ESPN, Court TV, and many more. There also will be, of course, Wink-enhanced commercials that will allow consumers to order products, get brochures, etc. In addition to DirecTV, cable companies such as TCI and Comcast have agreed to carry Wink-enhanced programming. No computer connection is needed with the system.

As you can see, CES introduced a bevy of enhancements for the TV viewer. However, to some, there are aspects of TV that they would like to see, shall we say, less enhanced. One such aspect is the increasing use of questionable language, especially on cable TV. For those viewers, Principal Solutions has introduced their TVGuardian "foul language" filter. It allows viewers the choice of three modes (strict, tolerant, and off). When questionable language is used, the unit detects it, mutes it, and replaces the language with a more acceptable word or phrase. The TVGuardian does not affect the video.

Well, there you have it—almost. In an article of this size it is impossible to cover all of the wonderful—and some not so wonderful—products at a show such as CES. One thing is clear, however; next year's show will have to go quite some distance to top this year's event. Ω

EARN BSEE DEGREE
EFFECTIVE HOME STUDY PROGRAM
Highly Effective BSEE Degree Program for Experienced Electronic Technicians. Our New Advanced Placement Program grants Credit for previous Schooling & Profesisonal Experience. Advance Rapidly! Established over 50 Years!
FREE DESCRIPTIVE LITERATURE!
CIE COOK'S INSTITUTE OF ELECTRICAL ENGINEERING
PO BOX 20345, JACKSON, MS 39209 601-371-1351

THE COLLECTED WORKS OF MOHAMMED ULLYSES FIPS
#166—By Hugo Gernsback. Here is a collection of 21 April Fools Articles, reprinted from the pages of the magazines they appeared in, as a 74-page, 8½ × 11-inch book. The stories were written between 1933 and 1964. Some of the devices actually exist today. Others are just around the corner. All are fun and almost possible. Stories include the Cordless Radio Iron, The Visi-Talkie, Electronic Razor, 30-Day LP Record, Teleyeglasses and even Electronic Brain Servicing. Get your copy today. Ask for book **#166** and include **$9.99 (includes shipping and handling)** in the US (First Class), Canada and Overseas (surface mail), and order from **CLAGGK Inc., P.O. Box 4099, Farmingdale, NY 11735-0793.** Payment in US funds by US bank check or International Money Order. Allow 6-8 weeks for delivery. MA05

The Y2K Bug

and a Few Other Worries

While almost everyone is aware of the Y2K bug, many don't know that there are a few other nasty date-related surprises lurking out there. This survival guide gives you the lowdown on what problems might lie ahead, and what precautions you need to take to survive the coming bug season.

BOB DYBALL AND GREG SWAIN

Suppose someone mentioned these dates: August 21, 1999, September 9, 1999, February 29, 2000, and January 18, 2038? Would they mean anything to you? No?—Then how about an easy one? What about December 31, 1999?

Of course the latter will immediately evoke a response. It's the end of the century and the end of the, millennium—a time for parties and revelry, and perhaps a little paranoia. Of course, as purists will quickly point out, the millennium does not really end until December 31, 2000, but since the rollover from the year 1999 to the year 2000 seems far more significant to most than the actual end of the millennium, who are we to argue?

However, whether you hold the pedantic or popular view on the end of the millennium, December 31, 1999 will likely be a date you remember for a long time, no matter how hung over you are from that night's parties. The reason is the so-called Y2K bug that makes it virtually a certainty that at least a few computers will cease to work correctly at midnight on that day. What will be the impact of that? It could be negligible or catastrophic. In fact, if you listened to some of the most extreme predictions of doom and gloom, you could be forgiven for wondering if the Earth will stop spinning at midnight on that date.

How could this have happened? Are the predictions of doom justified or overblown? What can you do to minimize any effects on your computer systems or your life? We'll tackle those questions a little later in this article. First, however, we are going to see if we can ratchet up your paranoia level by introducing you to a few more memorable dates. While these have not had the exposure that the Y2K bug has, they could make your life nearly as miserable. Buckle up, because here we go:

August 21 1999. What's the significance of this seemingly innocuous date? Well, that date is the week-zero rollover for GPS navigation systems.

In greater detail, August 21, 1999 is the last day of week 1023 of the GPS system. However, the system was only designed to count from 0 to 1023 in the first place. This means that on August 22, 1999, the GPS satellites will be broadcasting that it is week 0.

It is expected that some GPS ground systems will just stop working, having severe problems with the rollover. Others may need only a simple modification, though it might entail sending it back to the factory to make sure that they continue working properly and display August 22, 1999 instead of January 6, 1980, or something worse.

Most GPS systems manufactured over the last couple of years should have no problems, but be sure to check with your supplier. If you have a GPS mapping system for your computer, it might also pay to check now for any updates. More information on this, as well as useful links on the subject, can be found on a Web site maintained by the U.S. Coast Guard; see the box entitled Y2K Web Sites for the URL.

September 9, 1999 (9/9/99). This could be a real sleeper in some applications. That's because software writers occasionally used 9/9/99 to indicate unknown infor-

This story first appeared in *Silicon Chip, Australia* (January 1999); reprinted with permission

mation. Basically, this was a date that was never supposed to happen during the life of the program. It means that some applications will fail before the year 2000 is reached.

February 29, 2000. The year 2000 is a leap year but apparently not all systems or applications will recognize it as such and will miss the day altogether. Such systems will incorrectly roll from February 28, 2000 to March 1, 2000.

The reason for this confusion is that the year 2000 is a special case that occurs once every 400 years. The rule governing leap years is that a year is a leap year if it is divisible by four but not by 100. However, there is an exception: if the year can be divided by 400, then it is a leap year.

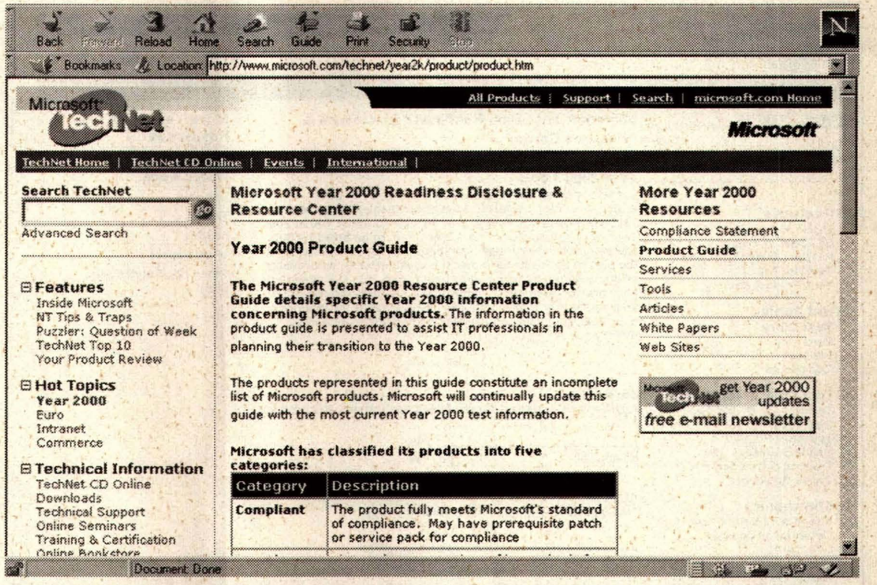
Confused? Let's look at the year 1900. It is divisible by four and by 100 but not by 400, so it wasn't a leap year. However, the year 2000 is divisible by 400, so it is a leap year.

As a result, many sources suggest that the system be checked to ensure that it rolls correctly from the February 28 to February 29, 2000, and from there to March 1, 2000. In fact, most year-2000 diagnostic utilities (more on those later on) automatically check the system to ensure that the leap year will be handled correctly.

That said, there's a wealth of opinion that states that the leap year problem doesn't exist since a standard computer real-time clock (RTC) automatically provides for a leap year if the year is divisible by four. This means that the year 2000 will be correctly interpreted as a leap year, but it won't hurt to check anyway.

January 18, 2038. Talk to anyone with UNIX, or a UNIX-related system, and they'll probably be laughing at PC and Windows users who are sorting out the Y2K problem. Why? Well UNIX applications usually (but not always) use a special date/time library (CTIME) in which dates start from 1970 and don't run out until January 18, 2038. On that date, however, UNIX systems have their own real problem because the date resets to 1970 again! Note, however, that some UNIX systems could still have problems after 12/31/99 as some applications might deal with dates in a 2-digit manner.

December 31, 1999. Given the publicity, it is unlikely that anyone out there has not heard of the Y2K bug, also know as the year-2000 bug or the millennium bug. It of course refers to the fact that many computer systems will not roll over correctly from December 31, 1999 to January 1, 2000. Instead, they will roll over to 1900 or 1980 instead.



http://www.microsoft.com/technet/year2k/product/product.htm

Search TechNet

Advanced Search

⊟ Features
  Inside Microsoft
  NT Tips & Traps
  Puzzler: Question of Week
  TechNet Top 10
  Your Product Review

⊟ Hot Topics
  Year 2000
  Euro
  Intranet
  Commerce

⊟ Technical Information
  TechNet CD Online
  Downloads
  Technical Support
  Online Seminars
  Training & Certification
  Online Bookstore

Microsoft Year 2000 Readiness Disclosure & Resource Center

Year 2000 Product Guide

The Microsoft Year 2000 Resource Center Product Guide details specific Year 2000 information concerning Microsoft products. The information in the product guide is presented to assist IT professionals in planning their transition to the Year 2000.

The products represented in this guide constitute an incomplete list of Microsoft products. Microsoft will continually update this guide with the most current Year 2000 test information.

Microsoft has classified its products into five categories:

Category	Description
Compliant	The product fully meets Microsoft's standard of compliance. May have prerequisite patch or service pack for compliance

More Year 2000 Resources
Compliance Statement
Product Guide
Services
Tools
Articles
White Papers
Web Sites

Microsoft's year 2000 Web site includes detailed compliance information on operating systems and applications. It also includes Y2K fixes that can be downloaded and applied to problem programs.

The older the computer the more likely it is that it has the Y2K bug. The bug will also affect many applications programs; again, the older the application, the more likely it is that it will suffer year-2000 problems.

So how did this come to be? Basically, the problem can be traced back to the early days of computing and the practice of using only two digits to represent the year. That practice, possibly introduced to save storage space, was subsequently carried over to the age of the PC.

If you "dig down" into the hardware of a PC, you'll find a real-time clock (RTC) chip. The RTC keeps track of the time and date and updates the CMOS memory, which is backed up by an onboard battery when the machine is off. The year information in the CMOS is passed on to the system BIOS each time the machine boots.

When the RTC was first introduced in PC-architecture machines, eight bits were set aside to hold the year. Since that is only enough for two digits, the century information was stored in non-volatile memory in the clock chip; combining the century data in memory with the year data, yields a full four-digit year.

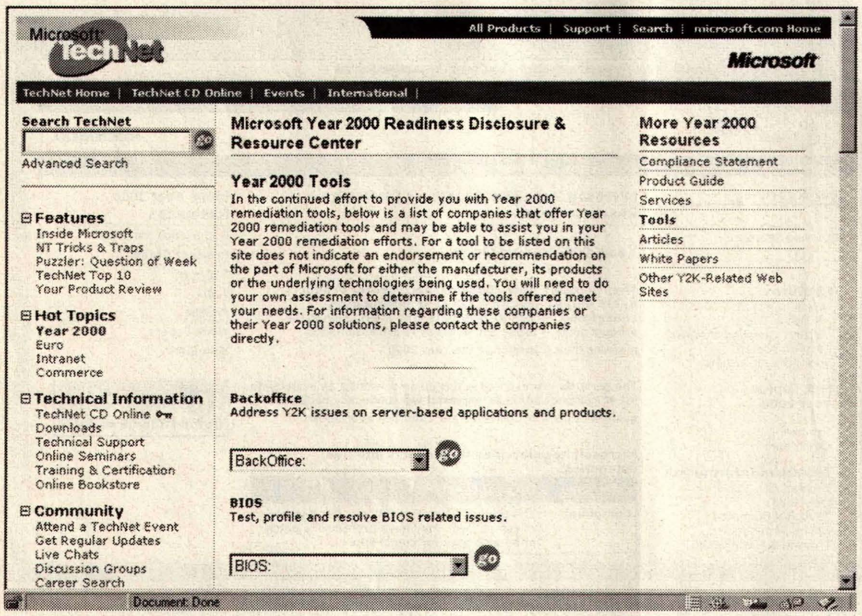
But there was a critical design error here. All early RTCs, and even some more modern ones, provide no way to update the century memory location. Because of that, things break down when we get to the year 2000. At that point, the RTC rolls the year from 99 to 00 but the century in memory remains fixed at 19. As a result, the RTC reports the date as January 1, 1900 instead of January 1, 2000.

What happens next depends on the system BIOS, or more specifically on what type of BIOS is built into the PC. When the machine is rebooted, some BIOSes will simply reflect what is in the system clock and will show 01/01/1900. Other BIOSes will interpret year 00 as 01/01/1980. As a result, the system rolls over from either 1999 to 1980 or from 1999 to 1900.

However there is a complicating factor. Microsoft operating systems (Windows and DOS 6.22) don't recognize 1900 as a valid date.

Instead, when the operating system boots, it automatically resets the system clock to January 4, 1980; or at least, this is what happens with DOS 6.22, Windows 3.1x, and Windows 95.

Windows 98, Windows NT 3.51 (Service Pack 5), and Windows NT 4 behave differently. According to Microsoft, those operating systems include a BIOS "fix" that automatically resets the year 1900 to 2000. However, some BIOSes will revert to 1900 every time the system reboots.



Microsoft Year 2000 Readiness Disclosure & Resource Center

Year 2000 Tools

In the continued effort to provide you with Year 2000 remediation tools, below is a list of companies that offer Year 2000 remediation tools and may be able to assist you in your Year 2000 remediation efforts. For a tool to be listed on this site does not indicate an endorsement or recommendation on the part of Microsoft for either the manufacturer, its products or the underlying technologies being used. You will need to do your own assessment to determine if the tools offered meet your needs. For information regarding these companies or their Year 2000 solutions, please contact the companies directly.

Backoffice

Address Y2K issues on server-based applications and products.

BIOS

Test, profile and resolve BIOS related issues.

The Microsoft year 2000 Web site has links to numerous "Year 2000 Tools" that can be used to assess Microsoft products. There are also links to numerous third party suppliers with Y2K diagnostic utilities, some of which can be downloaded for free.

In that case, Microsoft's BIOS fix will only work until the year 2001 is reached. When that happens and the system BIOS rolls over to 1901, the fix will not work and the operating system will revert to 1980.

Now let's inject an air of reality here. Generally, it's older machines that have BIOSes with this type of problem. You're not likely to be running Windows NT or Windows 98 on a 486, and if you are, it's probably time for an upgrade anyway!

Note that if a non-compliant machine is left running during the rollover, the DOS date will be updated correctly to 01/01/2000. However, that doesn't necessarily mean that all applications will work correctly. Some applications take the date from the BIOS rather than from the operating system.

What's more, if the BIOS date reverts to 01/01/1900 or 01/01/1980, the operating system date will also be incorrect when the machine is next rebooted. However, if you manually correct the date in CMOS setup, many machines will maintain the correct setting from that point on and even rebooting will not cause any problems.

The Award 4.50g BIOS can pose particular problems. Some versions of this BIOS will not allow any year that's less than "94", which means that 1900 becomes 1994 and 2000, 2001, 2002, *etc.* become 2094. This means that the machine will roll over from 1999 to 1994 and you cannot correct the situation by manually resetting the BIOS clock.

Although many RTCs in recent machines are still technically non-compliant, a "fix" is incorporated into the BIOS to overcome the Y2K problem. Basically, the BIOS corrects the date in the CMOS at bootup time and that is subsequently passed on to the operating system. Most (but not all) of the later Pentium machines fall into this category and so will correctly rollover to the year 2000.

In summary, the CMOS RTC almost always fails to increment from 1999 to 2000 (except for the very latest RTCs), but this usually doesn't matter—very few programs access it directly (and these would now usually be considered obsolete). What does matter is whether the BIOS fixes the problem so that both the BIOS and operating-system dates are correct.

Testing Your System. So how can you check to see if your system rolls over to the year 2000 correctly? Well, you could reset your system clock to a few minutes before midnight on 12/31/99, but that might not be the best idea as there could be unforeseen consequences.

For example, if you have a program that is only registered for a certain period of time, it might stop working. In addition, anything that schedules events, including e-mail delivery, could cause lots of problems. Even year-2000 compliant applications could cause problems if you move the clock forward to the year 2000, run the program, then change the clock back again.

Instead, the best way to test your system is to use a bootable floppy disk (created using DOS 6.22 or later). That way, you can avoid writing any information to the hard disk, which might alter vital files. Make sure that the machine on which you create the bootable floppy is clean of viruses, then change the boot order in your BIOS (CMOS) setup to A: C: (normally it should be on C: A: or C: only, to prevent accidental infection if a virus-infected disk is left in the A: drive).

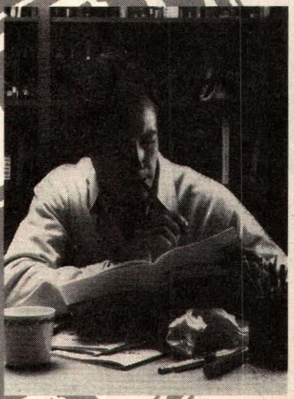
Although not considered totally reliable, a manual check can give a good indication as to how your system will behave when the year 2000 ticks over. The basic procedure involves setting the system clock to one minute before midnight on 12/31/1999 and then observing what happens when the system rolls over into the year 2000. However, to property determine the system's behavior, you need to test two conditions:

(1) What happens if the machine is switched off during the rollover; and

(2) what happens if the machine is left switched on during the rollover and then rebooted.

1 Study at Home

We live in a constantly changing world, where exciting new technological advancements are made everyday. At the Cleveland Institute of Electronics we make it simple to train, earn a degree and prosper in the workforce. Over 150,000 students in the United States and 70 foreign countries got their start in electronics through CIE. And they received their education at their own pace in the comfort and convenience of their homes. At CIE you'll receive a first class education by a faculty and staff devoted to your career advancement. All of CIE course and degree programs are taught through a patented, proven learning process. To discover all the benefits and programs/ degrees available from CIE send for your free course catalog today.



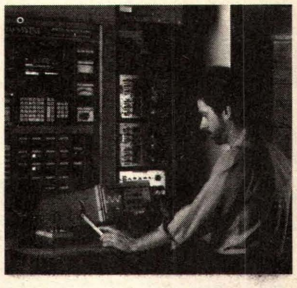
CIE's Associate Degree program contains 397 lab experiments.

2 Work Where You Want

And once you complete your education at CIE, you can just about write your own ticket to where you want to work and in what specialized field... MIS, broadcasting, industrial, automotive, management... The opportunities seem limitless in today's high-tech world.

The Cleveland Institute of Electronics has been approved for use of Veterans Affairs Benefits and DANTES Tuition Reimbursement.

Tuition assistance from the Veterans Administration or the DANTES Program is available to veterans and service members in the Armed Forces.



Employees are seeking & hiring qualified applicants.

FREE
CATALOG

CIE
1776 E. 17th Street
Cleveland, Ohio 44114-3679

Visit Our Web-Site
www.cie-wc.edu

☐ **YES!** I am interested.
Please send me a catalog.

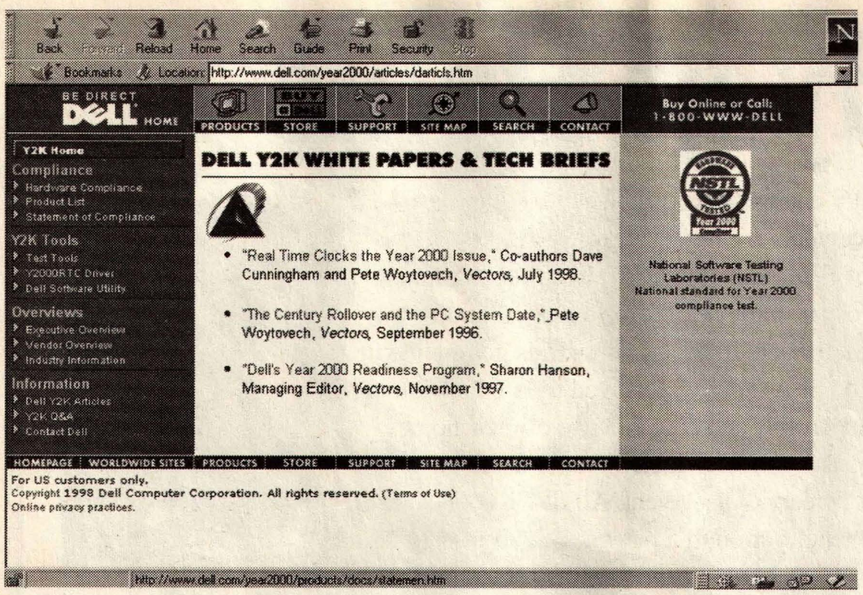
Name: ____________________

Address: ____________________

City: __________ State: ______ Zip: ______

Phone Number: ____________________

A school of thousands. A class of one. Since 1934. AE143



http://www.dell.com/year2000/articles/darticls.htm

DELL Y2K WHITE PAPERS & TECH BRIEFS

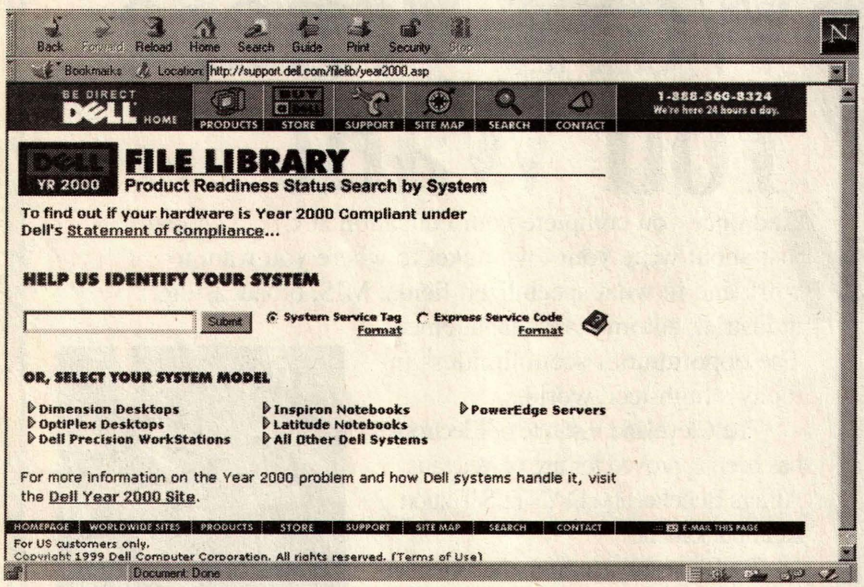
- "Real Time Clocks the Year 2000 Issue," Co-authors Dave Cunningham and Pete Woytovech, *Vectors*, July 1998.
- "The Century Rollover and the PC System Date," Pete Woytovech, *Vectors*, September 1996.
- "Dell's Year 2000 Readiness Program," Sharon Hanson, Managing Editor, *Vectors*, November 1997.

National Software Testing Laboratories (NSTL) National standard for Year 2000 compliance test.

For US customers only.
Copyright 1998 Dell Computer Corporation. All rights reserved. (Terms of Use)
Online privacy practices.

http://www.dell.com/year2000/products/docs/statemen.htm

Dell's Web site has some excellent material on the Y2K problem. There's a complete product list of Dell machines, a number of Y2K test tools that can be downloaded, and several easy-to-follow articles on the Y2K problem.



http://support.dell.com/filelib/year2000.asp

1-888-560-8324
We're here 24 hours a day.

FILE LIBRARY
Product Readiness Status Search by System

To find out if your hardware is Year 2000 Compliant under Dell's Statement of Compliance...

HELP US IDENTIFY YOUR SYSTEM

● System Service Tag Format ○ Express Service Code Format

OR, SELECT YOUR SYSTEM MODEL

- Dimension Desktops
- OptiPlex Desktops
- Dell Precision WorkStations
- Inspiron Notebooks
- Latitude Notebooks
- All Other Dell Systems
- PowerEdge Servers

For more information on the Year 2000 problem and how Dell systems handle it, visit the Dell Year 2000 Site.

For US customers only.
Copyright 1999 Dell Computer Corporation. All rights reserved. (Terms of Use)

Document: Done

If you have a Dell computer, you can check its Y2K status and, if necessary, download a BIOS update or software patch.

First, boot from the floppy disk to the A: prompt and change the date and time to one minute before midnight on December 31 1999, You do that by first typing "date" (without the quotes, of course) at the A: prompt and then typing in the new date (*i.e.*, 12/31/1999). When that's done, type "time" and change the time to 23:59.

Note that this procedure not only changes the operating system clock but also changes the date and time in the BIOS and RTC as well.

Now turn the PC off; wait a couple of minutes; then switch the machine back on and check the date, day, and time in the BIOS (*i.e.*, CMOS) setup. PCs with non-compliant BIOSes will usually drop back to 01/01/1980 or to 01/01/1900, but some will go to 01/01/1994.

Now exit the BIOS setup without making any changes, boot from the floppy disk and check the date—just type "date" at the DOS prompt and hit the ENTER key. If the BIOS previously indicated 01/01/1980, then this date will also be shown when you type "date" at the DOS prompt. However. if the BIOS previously reverted to 01/01/1900, DOS 6.22 will change this to January 4, 1980 (01/04/1980).

You can now check to see what happens when the machine is left on. Once again, boot from the floppy, change the date and time, to a couple of minutes before midnight on December 31,1999 and leave the machine running during the rollover. Now reboot the machine and check the date. If the machine is non-compliant, you will find that the DOS date will be incorrect after the reboot.

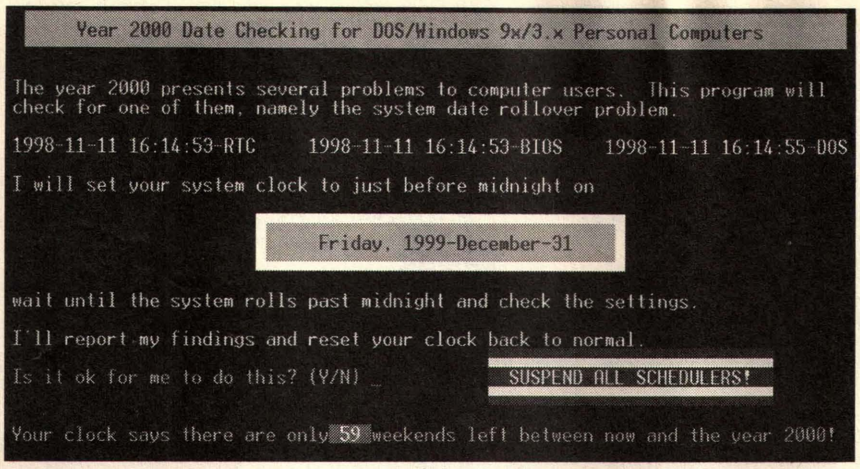
Assuming a non-complaint system, try manually setting the date to the year 2000 (*e.g.*, 1/1/2000) in the BIOS setup, then switch the PC off and reboot from the floppy disk. Recheck the date in the BIOS setup, then allow the machine to boot to the A: prompt and check it again. If the year is still 2000, this means that you should only have to reboot the PC and manually alter the date in the BIOS setup once when the year 2000 arrives. After that, the machine should be OK.

Finally, don't forget to reset the date and time to the correct values before booting from the hard disk.

Test Software. While if done carefully, a manual test like the one just described will work, a more reliable (and easier) way of testing your machine is to use one of the many commercial, shareware, and freeware software packages that are now available.

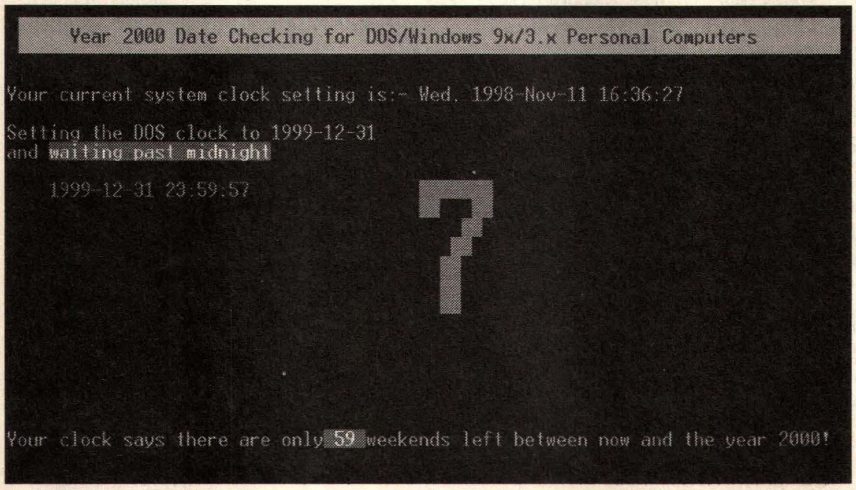
One very good commercial package is Check 2000 PC from Greenwich Mean Time (Web: http://www.gmt-uta.com/). That comprehensive package not only checks your PC for year-2000 compliance, but can also fix any BIOS problems it does find using a BIOS fix utility (for most BIOS types, that is). It can also scan your applications and data files and offer advice on fixing any problems. Other commercial Y2K auditing tools include McAfee 2000 Toolbox, OnMark 2000 Access, Norton 2000, and Express 2000 Suite.

There are also lots of utilities available on the Internet for checking whether your computer will cor-



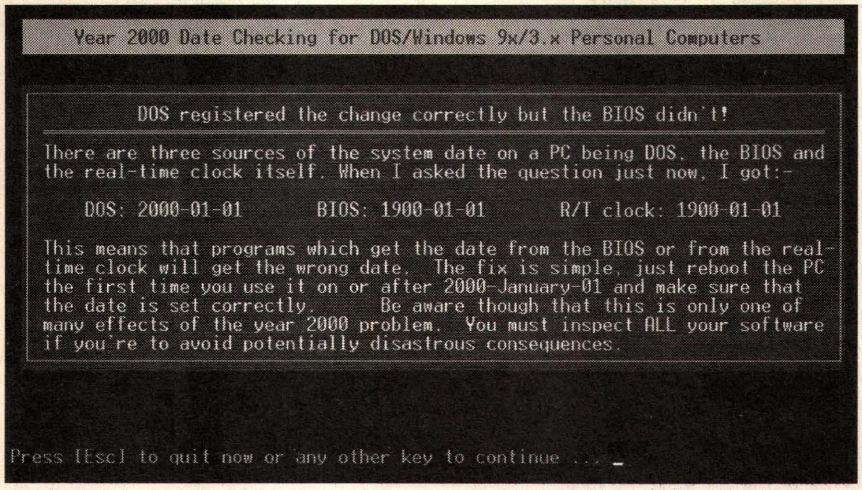
```
 Year 2000 Date Checking for DOS/Windows 9x/3.x Personal Computers

The year 2000 presents several problems to computer users.  This program will
check for one of them, namely the system date rollover problem.

1998-11-11 16:14:53-RTC     1998-11-11 16:14:53-BIOS    1998-11-11 16:14:55-DOS

I will set your system clock to just before midnight on

                  Friday, 1999-December-31

wait until the system rolls past midnight and check the settings.

I'll report my findings and reset your clock back to normal.

Is it ok for me to do this? (Y/N) _           SUSPEND ALL SCHEDULERS!

Your clock says there are only 59 weekends left between now and the year 2000!
```

DOSCHK.EXE is a small utility that can automatically test your PC for Y2K compliance. It starts by saving the current date and time, then resets the time to 5 seconds before midnight on 12/31/1999.



```
 Year 2000 Date Checking for DOS/Windows 9x/3.x Personal Computers

Your current system clock setting is:- Wed, 1998-Nov-11 16:36:27

Setting the DOS clock to 1999-12-31
and waiting past midnight

   1999-12-31 23:59:57

                          7

Your clock says there are only 59 weekends left between now and the year 2000!
```

Next, the program counts down to midnight on12/31/1999. An onscreen display shows the progress.



```
 Year 2000 Date Checking for DOS/Windows 9x/3.x Personal Computers

         DOS registered the change correctly but the BIOS didn't!

  There are three sources of the system date on a PC being DOS, the BIOS and
  the real-time clock itself. When I asked the question just now, I got:-

     DOS: 2000-01-01       BIOS: 1900-01-01       R/T clock: 1900-01-01

  This means that programs which get the date from the BIOS or from the real-
  time clock will get the wrong date.  The fix is simple, just reboot the PC
  the first time you use it on or after 2000-January-01 and make sure that
  the date is set correctly.      Be aware though that this is only one of
  many effects of the year 2000 problem.  You must inspect ALL your software
  if you're to avoid potentially disastrous consequences.

Press [Esc] to quit now or any other key to continue ... _
```

Finally the program displays the results and offers advice on a fix. As can be seen, this PC has gone back to 1/1/1900.

rectly roll over to the year 2000. Many of those are free for personal use and are quick and easy to use. As well as checking for year 2000 rollover, many check other critical dates as well.

One example is DOSCHK.EXE from Saphena Computing in the UK. The archived file can be downloaded from their Web site in less than a minute (see the Y2K Web Sites box for Web site address) and you simply copy the unzipped files to a directory on your boot floppy before running the program.

Basically, the program takes the tedium out of having to manually reset the time and date and reboot the computer on several occasions. It's also more comprehensive than the manual reboot test since it separately tests the RTC, the BIOS, and the operating system. A panel summarizes the results at the end of the test.

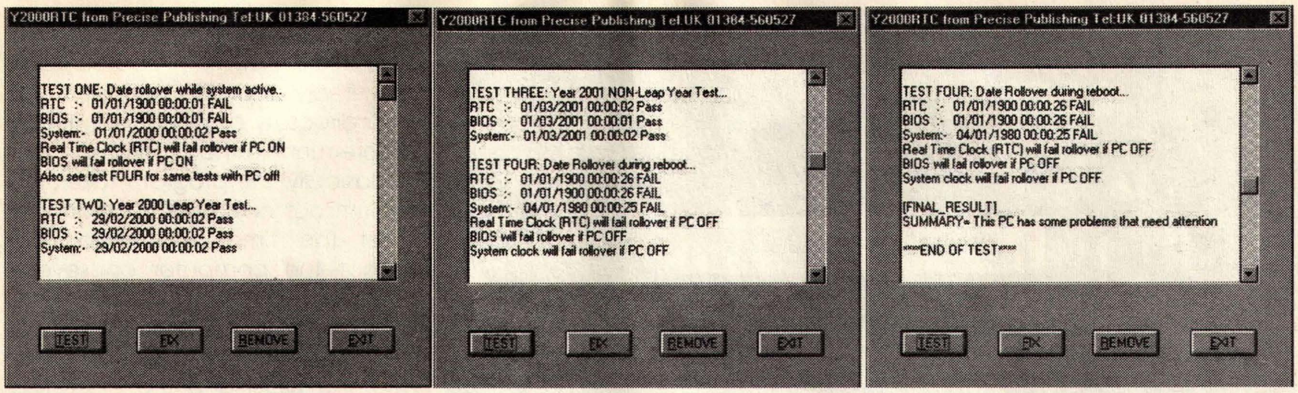
Another interesting millennium checker is Y2000RTC from Precise Publishing, another UK company. You can download Y2000rtc.zip (around 90 KB) from their Web site (again, see the Y2K Web Sites box) and, after unzipping, run Y2000.exe from DOS or Y2000W.EXE from Windows 3.1x or Windows 95/98.

If problems are discovered, you call install a driver file which, according to Precise Publishing, solves the problem by correcting the RTC. Precise Publishing even states that it can fix the "94" problem associated with Award 4.50G BIOSes. This driver file isn't included in the free test program; it has to be purchased separately.

YMARK2000 from NSTL is also well worth downloading. This interesting utility does more than just check the year-2000 rollover. It also checks for correct leap year support for the years from 2000-2009 and checks the RTC for compatibility with the Motorola M146818 chip (if the RTC isn't compatible, non-DOS operating systems and programs that read the clock directly may fail). In addition, YMARK2000 checks to see if the date can be set manually if the rollover to the year 2000 fails.

By the way, all the above diagnostic programs test the RTC, which invariably fails except on the very latest machines. However, as discussed above, the CMOS RTC date is unimportant unless you have one of those rare programs that accesses it directly. It is the BIOS date that really matters.

Yet another interesting diagnostic program is Test2000 from RighTime. This program first carries out a real-time BIOS rollover test. It then resets the date to 02/29/2000



```
TEST ONE: Date rollover while system active..
RTC  :-  01/01/1900 00:00:01 FAIL
BIOS :-  01/01/1900 00:00:01 FAIL
System:-  01/01/2000 00:00:02 Pass
Real Time Clock (RTC) will fail rollover if PC ON
BIOS will fail rollover if PC ON
Also see test FOUR for same tests with PC off!

TEST TWO: Year 2000 Leap Year Test..
RTC  :-  29/02/2000 00:00:02 Pass
BIOS :-  29/02/2000 00:00:02 Pass
System:-  29/02/2000 00:00:02 Pass
```

```
TEST THREE: Year 2001 NON-Leap Year Test...
RTC  :-  01/03/2001 00:00:02 Pass
BIOS :-  01/03/2001 00:00:01 Pass
System:-  01/03/2001 00:00:02 Pass

TEST FOUR: Date Rollover during reboot...
RTC  :-  01/01/1900 00:00:26 FAIL
BIOS :-  01/01/1900 00:00:26 FAIL
System:-  04/01/1980 00:00:25 FAIL
Real Time Clock (RTC) will fail rollover if PC OFF
BIOS will fail rollover if PC OFF
System clock will fail rollover if PC OFF
```

```
TEST FOUR: Date Rollover during reboot...
RTC  :-  01/01/1900 00:00:26 FAIL
BIOS :-  01/01/1900 00:00:26 FAIL
System:-  04/01/1980 00:00:25 FAIL
Real Time Clock (RTC) will fail rollover if PC OFF
BIOS will fail rollover if PC OFF
System clock will fail rollover if PC OFF

[FINAL_RESULT]
SUMMARY= This PC has some problems that need attention

****END OF TEST****
```

Y2000RTC is another free diagnostic utility. You can either run Y2000.exe from DOS or Y2000W.EXE from Windows 3.1x or Windows 95/98. These three screen grabs show the test results from a typical 486 PC.

and reboots the machine to see if valid year-2000 BIOS dates are retained (the BIOS retention test). The results are shown onscreen and are also written to a text file called Test2000.tst on the root directory of the hard disk. If the machine is non-compliant, Test2OOO.tst indicates whether the problem can be fixed using a proprietary utility program (Y2KPCPro).

TSRs and BIOS Cards. If your machine tests out to be non-compliant, is there anything that can be done, aside from scrapping it? Though learning that your hardware is non-compliant should be a fairly clear signal that it is time for an upgrade, that might not be feasible or desirable for various reasons. Then, you can try a BIOS upgrade or a TSR patch.

A TSR (terminate and stay resident) patch is basically a software routine that's loaded via the autoexec.bat file when the machine boots. In operation, the TSR fix checks the date in the BIOS and applies a correction if a date prior to 1980 is returned. A TSR isn't exactly foolproof though and might not work with some programs. It will also be lost if you reformat the hard disk drive (unless you remember to reinstall it), or can be inadvertently bypassed if you boot from a floppy disk or CD-ROM.

Alternatively, an add-on BIOS card that plugs into an expansion slot on the motherboard can be used to solve the problem in most machines. Its advantage is that the fix is permanent, but it costs more than a TSR fix.

Basically, the add-on card acts as an extension to the existing BIOS. It works by changing the century register in the RTC to 20 if a value of less than 80 is returned from the year register. However, as with TSR fixes, a BIOS card might not work with some programs. **Electronics Now** reviewed one such BIOS upgrade card—the Micro 2000 Centurion—in the February 1999 issue.

If your motherboard has flash BIOS, you may be able to download and upgrade the BIOS yourself. Just be sure to get the correct BIOS for your particular motherboard from the manufacturer's Web site. A word of warning here: updating the BIOS is not a job for a novice. If you make a mess of things, you could end up with a machine that won't boot.

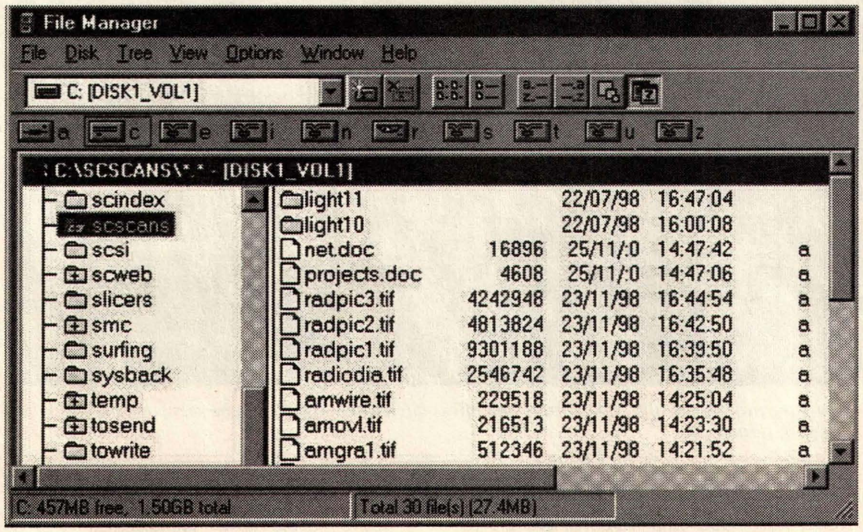
Another approach is to replace the BIOS chip itself. However, that may only be feasible if your machine is less than two or three years old.

Assuming that your hardware checks out fine or can be made compliant, we are in the clear, right? Wrong!

That's because we still have to deal with the software. Both operating systems and applications have significant Y2K issues, and we'll deal with them next.

Operating Systems. Fortunately, Microsoft's operating systems are either year-2000 compliant or compliant with minor issues. They all store and manipulate dates in 4-digit formats and all correctly recognize 2000 as a leap year.

What that means is that Microsoft operating systems won't



```
light11                      22/07/98  16:47:04
light10                      22/07/98  16:00:08
net.doc             16896    25/11/:0  14:47:42    a
projects.doc         4608    25/11/:0  14:47:06    a
radpic3.tif       4242948    23/11/98  16:44:54    a
radpic2.tif       4813824    23/11/98  16:42:50    a
radpic1.tif       9301188    23/11/98  16:39:50    a
radiodia.tif      2546742    23/11/98  16:35:48    a
amwire.tif         229518    23/11/98  14:25:04    a
amovl.tif          216513    23/11/98  14:23:30    a
amgra1.tif         512346    23/11/98  14:21:52    a
```

```
C: 457MB free, 1.50GB total        Total 30 file(s) (27.4MB)
```

The old Windows File Manager will display a garbled year for files created on or after January 1, 2000 if your version of winfile.exe is dated earlier than 3/11/97. A fix is available from Microsoft, but be sure to download the correct version for your operating system.

break down when the year 2000 rolls around, although you may discover a few quirks.

For example, the File Manager included with Windows 3.1x, Windows For Workgroups, and early releases of Windows 95 will display a garbled year for files created on or after January 1, 2000. The year 2000, for example, displays as 19:0, while 2020 displays as 19<0. Note, however, that these are only display artifacts; the underlying system date is handled correctly.

Basically, your File Manager will have the garbled date problem if your winfile.exe file is dated earlier than 3/11/97. A fix is available from the Microsoft Year 2000 Web site—just be sure to download the correct version for your operating system, as follows: w31filup.exe for Windows 3.1x, wfwfilup.exe for Windows For Workgroups, and w95filup.exe for Windows 95.

Even Windows NT Workstation 4.0 has some quirks and various fixes are available. However, the problems are all of a minor nature and most users won't even notice them.

Whatever version of the Windows operating system you are using, visit the Microsoft Web site and check out the details for yourself.

Applications. This is where the fun really begins. Just because your hardware is Y2K compliant, it doesn't mean that your applications will behave as expected. In particular, applications that specify the year using just two digits can cause problems, and that particularly applies to spreadsheet, accounting, payroll, and database programs.

As an example, if a date in a spreadsheet is specified as 10/21/27, how is it interpreted? Is the year 1927 or 2027? It all depends on the application, but the wrong result could easily make a mess of superannuation calculations or of any calculations that rely on future projections. In fact, a file can even give different results when opened in different versions of the same application.

It's important to ensure that your applications are year-2000 compatible and that the data is interpreted correctly. Many spreadsheet and database programs rely on Windows itself to set the default date display format. For this reason, it's advisable to set the Windows short-date display to "mm/dd/yyyy" using the Regional Settings applet in Control Panel.

Check with the software supplier. Do they have a certificate of compliance or some other guarantee that your software will work correctly? Do you need to upgrade? Answers to these questions are best provided by the company that produced the software.

Check the vendor's Web site for Y2K information. In the case of non-compliant software, it might be possible to make your software compliant by downloading and applying patches. Often, however, it will be better to upgrade your applications to the latest versions and apply any patches (if necessary) from there, particularly for applications that are used in business.

By the way, it's not sufficient just to bring individual computers and applications up to speed. If you are

Y2K WEB SITES

The Year 2000 Problem

www.microsoft.com/year2000/	Microsoft's year 2000 Web site. Lots of information on operating systems and applications, plus numerous links to various diagnostic utilities, etc.
www.novell.com/year2000/	Information on Novell products and Y2K compatibility.
www.year2000.com	Lots of information on the Y2K problem plus links to manufacturers.
www.sba.gov/y2k/	Year 2000 Web site for the US Government Small Business Administration.
www.garynorth.com/	The Year The Earth Stands Still—an interesting viewpoint on the year 2000 problem. Read it if you're still complacent.

Some Useful Y2K Diagnostic Utilities

ourworld.compuserve.com/homepages/saphena/year2000.htm	Saphena Computing's DOSCHK.EXE diagnostic utility.
www.precise.co.uk/Y2000.htm	Precise Publishing's Y2000RTC.zip diagnostic utility.
www.nstl.com/html/nstl_ymark2000.html	NSTL's YMARK2000 diagnostic utility.
www.RighTime.com	RightTime's Test2000 diagnostic utility.

Computers Suppliers &Y2K

www.dell/com/year2000/	Lets you check your Dell system for compliance. BIOS updates and drivers can be downloaded if necessary.
www.gateway.com/year2000/	Gateway's Year 2000 site
www.ibm.com/IBM/year2000/	IBM's Year 2000 site
www.compaq.com/year2000/	Compaq's Year 2000 site

Global Positioning Satellite (GPS) Navigation System

www.navcen.uscg.mil/gps/geninfo/y2k/default.htm	GPS date rollover issues plus a list of GPS manufacturers.

in business, you must consider what happens when you exchange data with others, either via a local network, via e-mail, or by some other means. You also have to consider what happens if you exchange data between different applications.

HOW TO MANUALLY TEST YOUR PC FOR THE YEAR 2000

Step 1: Boot from a floppy disk created using DOS 6.22 or later.
Step 2: Type "date" (without the quotes) and change the date to 31-12-1999.
Step 3: Type "time" and change the time to 23:59 (i.e., to one minute before midnight).
Step 4: Switch off, wait for two minutes, then re-apply power and enter the BIOS setup. Check the date. If the year isn't 2000, then your machine is non-compliant.
Step 5: Exit the BIOS setup without saving and allowing the machine to boot from the floppy disk.
Step 6: Type "date." Machines with non-compliant BIOSes will usually show either January 1st 1980 or January 4th 1980.
Step 7: Reset the date and time to the correct values.

Look out for all the small things—things like third party add-ons, macros, and formulas in spreadsheets and other applications. Those can all have problems, especially if you've been using a two-digit year format. They can even cause problems with applications that are, by themselves, year-2000 compliant.

Finally, it's important to realize that here's no magic cure-all for the Y2K problem. Everything must be tested on its own merits and the appropriate solutions implemented. But even though most of the problems are well known, not many of the thousands of individuals specializing in the Y2K problem will give a 100% guarantee that their solutions will work without any hiccups.

What About Apple Computers? Does the fact that we've been mainly dealing with Windows systems mean you can afford to be a little smug here if you own an Apple Mac? Maybe.

According to Apple, the Mac operating system has always correctly handled dates between January 1, 1904 and February 6, 2040. What's more, the current Mac OS date and time utilities correctly handle dates between 30,081 BC and 29,940 AD.

Apple also states that all applications that use the Mac OS date and time utilities will have no problem when the year 2000 rolls around. However, there could be problems with applications that don't do this. Once again, it's best to check with the company that supplies the software.

One issue affecting the Apple Mac is that the date and time control panel only allows the year to be set in the range from 1920-2019. However, it's possible to set dates beyond 2019 using the SetDateTime toolbox.

For more information on Apple hardware and software Y2K issues, visit the Apple Web site (www.apple.com/about/year2000).

Embedded Controllers. It's not only computers that could have problems handling the transition to 2000. Many of today's so-called "high-tech" systems contain embedded controllers. That includes medical equipment, car computers, traffic lights, VCRs, industrial process control, office equipment, PABXs, air-conditioning plants, building access controls, and alarm systems, to name just a few.

Of course, only some of these controllers are date dependent, but those that are could cause problems in the year 2000 if not replaced or modified. The effects, of course, will depend on the equipment. In some cases, the equipment will continue to operate normally (although it will report the wrong date) but in other cases, the equipment could malfunction or cease working altogether.

Y2K Web Sites. It should come as no surprise that there's a wealth of information on the World Wide Web on the Y2K problem, and it's well worth visiting some of the sites listed in the accompanying Y2K Web Site box. It's also a good idea to check out the Web sites for your BIOS supplier and your computer (and/or motherboard) supplier. They will have tested many more dates and times than you would normally be able to check and might have patches or BIOS updates available for older PCs.

One site that's especially well worth checking out is www.microsoft.com/year2000. This large site hosts detailed information on Microsoft operating systems and applications and includes Y2K fixes that you can download and apply to any problem programs. It also has links to year 2000 "White Papers," a section with frequently asked questions (FAQs), and links to external suppliers and companies offering Y2K diagnostic utilities.

Another site that you should check out is www.year2000.com. And, if after all this you still feel complacent about the problem, check out Gary North's site: www.garynorth.com for some very frightening projections.

Conclusion. This article is intended as a general guide to the year-2000 problem only, and is by no means exhaustive. Because of the wide variations that exist in computer hardware, operating systems, and applications, it is impossible to offer specific advice that covers all situations. In fact, while the procedures, diagnostics, and products presented here are effective in most situations, they might not be in yours. If in doubt, seek professional help, especially if computers and the data they hold are critical in your business.

In short, if you are involved in any sort of business that operates computers, then you cannot afford to ignore the year-2000 problem. In particular, it's vital that you seek professional help in overcoming year-2000 problems and that all systems and applications be thoroughly tested well before 2000 rolls around. Ω

POPTRONIX®
Online Edition
We're on the web FREE
http://www.poptronix.com

DEMODULATE TV SIGNALS WITH A VIDEO IF STRIP

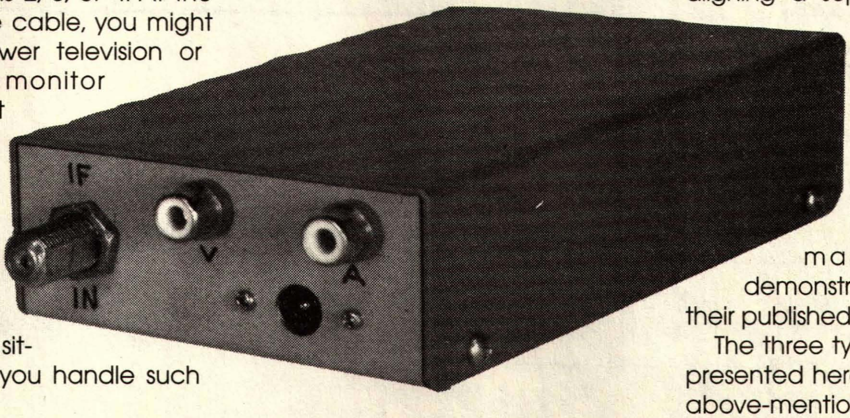
Separate baseband video from its carrier wave with these low-cost demodulators.

WILLIAM SHEETS
AND
RUDOLF F. GRAF

When working with video signals (the content, not the actual signal itself), it is important to know whether the source of a signal is a baseband signal or modulated on a radio-frequency (RF) carrier. For example, video sources such as video cameras and most VCRs might have a video-out jack that supplies baseband video, but older or "bottom-line" VCRs might have only a TV-antenna output—perhaps on a lower VHF frequency such as Channels 2, 3, or 4. At the other end of the cable, you might not have a newer television or home-theatre monitor that has a direct video-input jack to handle the computer video, or you might only have a baseband monitor available for the VCR situation. How do you handle such mismatches?

One device that is readily available often at low prices on the surplus market is a video modulator. That device (as its name implies) takes a baseband video signal and accompanying audio and modulates it onto a television channel. It is then a simple matter to connect the modulator's output to the antenna jack of a television and tune the set to the correct channel.

Unfortunately, if you have an RF-modulated video signal and need to convert it to baseband video the situation is not so simple. One solution might be to salvage the tuner and intermediate-frequency (IF) strip from a junked television. Assuming that those components are functional, you'll still need the proper supply voltages to run the setup. An alternative would be to use a modern VCR, but it can be large and expensive if you need to dedicate a unit to your project. There is also the possibility of family disharmony if you keep "borrowing" the VCR if someone else wants to watch a tape or record a program for later viewing.



There are also situations where even those solutions will not work, such as with the partially demodulated output of a TV tuner or the reception of amateur-, satellite-, or microwave-television broadcasts. In the first situation, television audio and video signals are modulated together on a subcarrier frequency in the 44-MHz range, whereas the other situations usually use a frequency-modulated (FM) format at around 70 MHz.

In all of those cases, the best solution would be to have a dedicated IF circuit tailored to the particular needs of the received signal. Years ago, the construction of an IF circuit beyond a simple 455-kHz AM-radio system was considered to be in the realm of experienced RF engineers. Even if a good design was available, sophisticated and specialized test equipment was needed to set up and align such circuitry. That equipment was both expensive and difficult to find for the average experimenter or hobbyist.

Today, the availability of prepackaged surface-acoustic-wave (SAW) filters and related ICs have taken much of the pain and effort out of aligning a sophisticated IF circuit. The filters have fixed bandwidth characteristics, eliminating the need for alignment. Even the basic IF circuits themselves are often provided by IC manufacturers as a demonstration application in their published data sheets.

The three types of Video IF Strips presented here will cover all of the above-mentioned situations easily: a 44-MHz demodulator for use with a TV tuner, a 66-MHz strip for separating video and audio from VHF Channel 3 or 4 signals, and a 70-MHz unit for use with FM television. Each device has a standard video output that can be connected to any NTSC-compatible monitor. They are compact, low in cost, and easy to tune and set up using only common test equipment that is readily available; in fact, the video experimenter probably already has that equipment on the workbench!

The IF66. We'll start by examining the schematic diagram of the 66-MHz unit, which will be referred to as the IF66; its schematic diagram is shown in Fig. 1. A video signal at 1 mV or greater on a 60- or 66-MHz

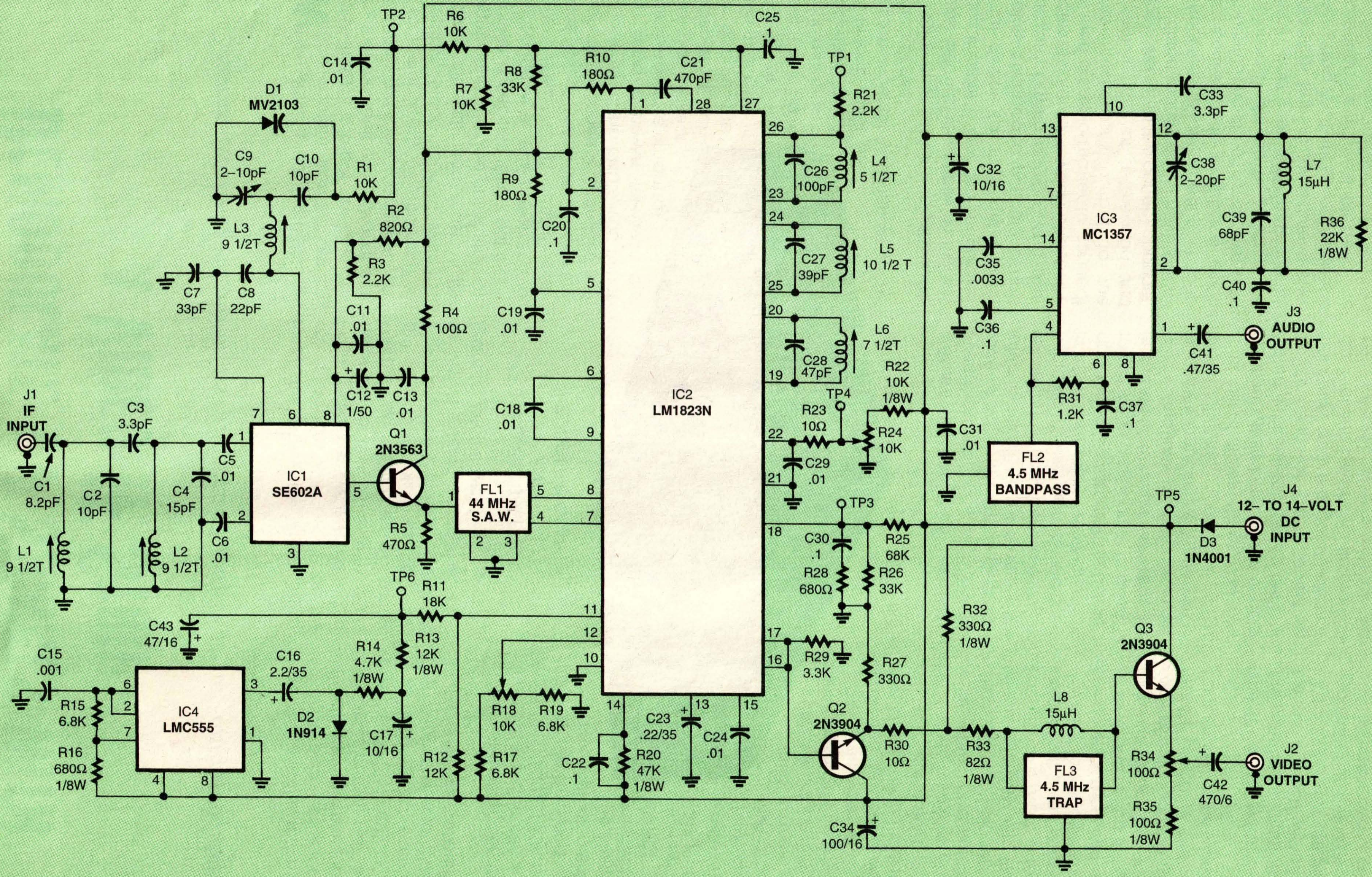


Fig. 1. The 66-MHz version of the Video IF can display any television signal on channel 3 or 4 on an NTSC video monitor. With a slight modification, the unit can be tuned to work with channels 2 through 6.

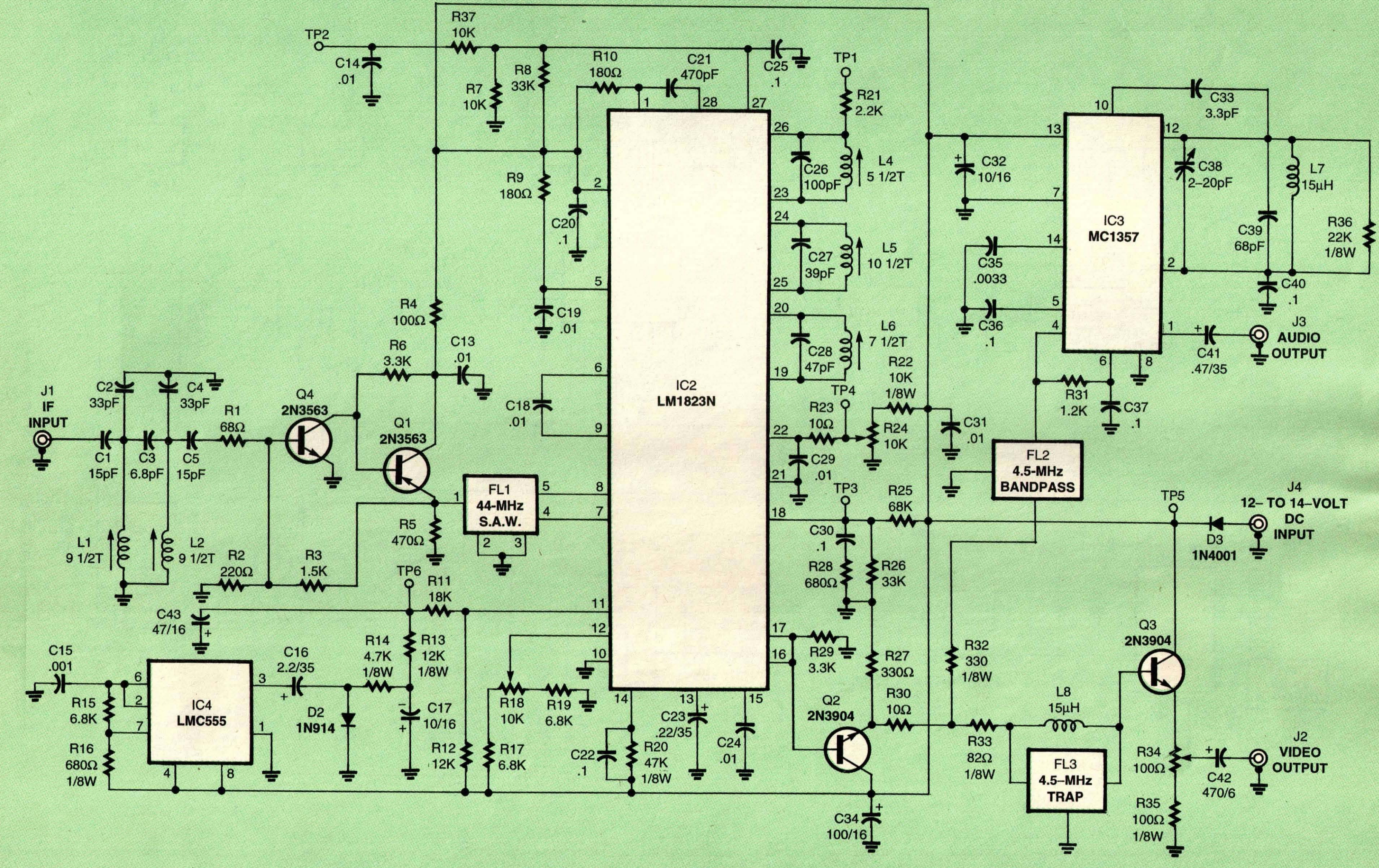


Fig. 2. The IF44 can be used to view the video from a standard TV tuner.

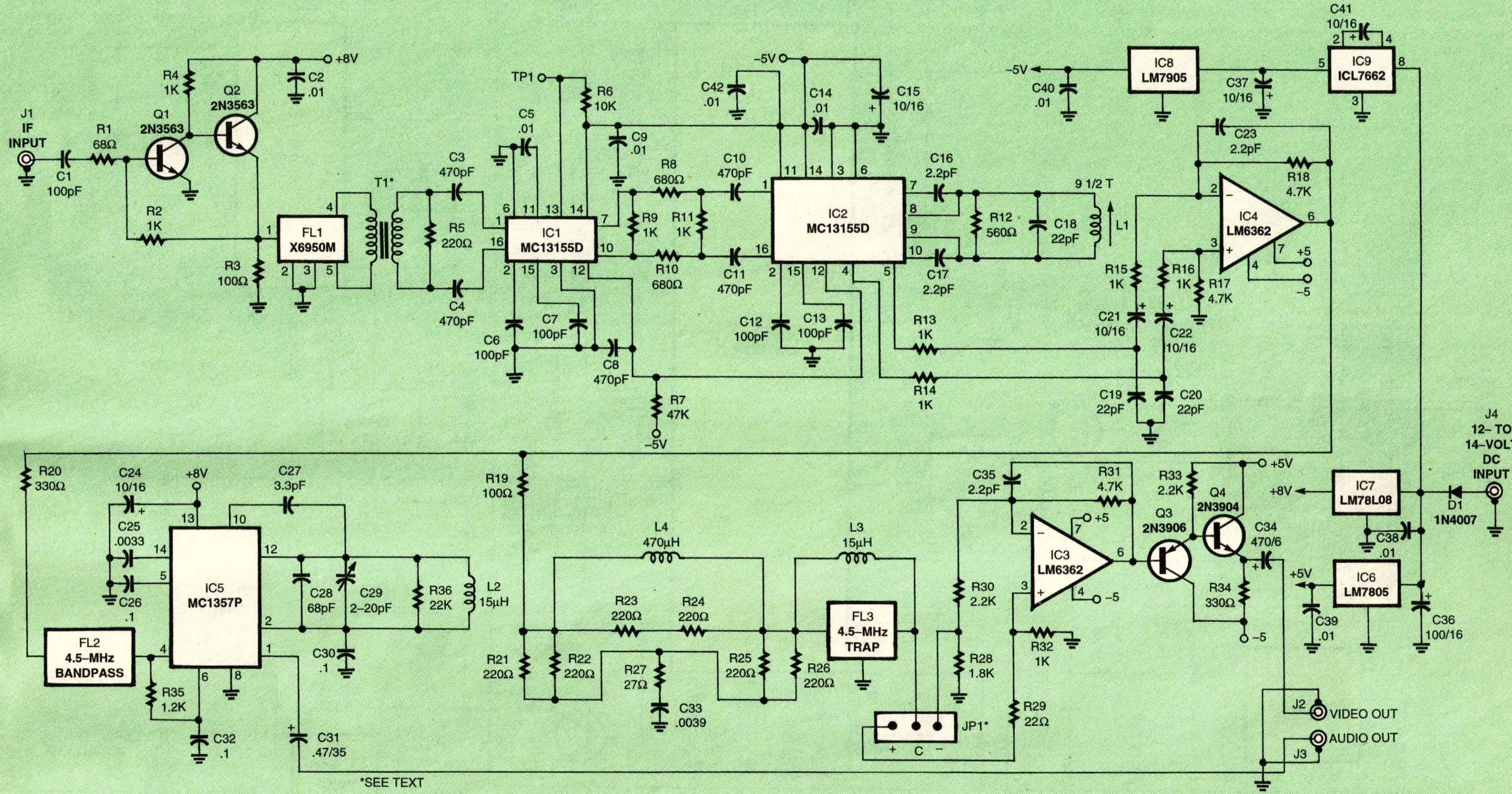


Fig. 3. This version of the Video IF can be used to view FM television signals as found on some satellite broadcasts and amateur television experiments in the microwave bands.

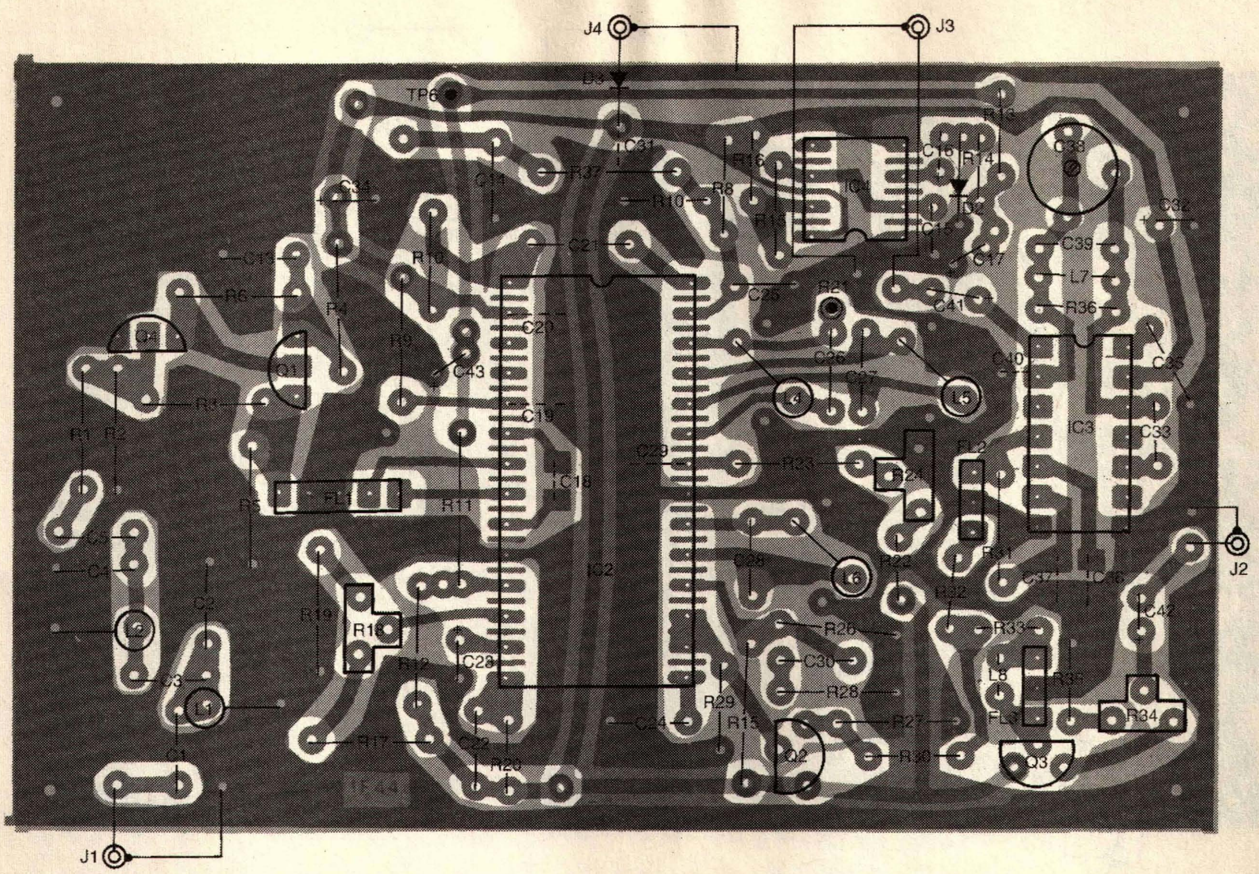


Fig. 4. The IF44 fits neatly onto a double-sided PC board. Note that a few surface-mounted capacitors are mounted on the solder side of the board.

carrier (Channel 3 or 4, respectively) is fed through J1 to a bandpass filter consisting of C1–C4, L1, and L2. That filter is designed to pass frequencies between 59 and 73 MHz at the 3-dB points. The filtered signal is fed to mixer IC1 through C5, where the incoming signal is mixed with an internally generated local-oscillator signal. The local-oscillator frequency is set by L3, C7–C10, and D1. That frequency needs to be the sum of the IF frequency (45.75 MHz) and the incoming carrier signal (61.25 or 67.25 MHz)—107 or 113 MHz. Since IC1 produces both the sum and difference frequencies, only the 45.75-MHz signal will be used. A voltage from an automatic fine-tuning circuit (AFT) is applied to D1 in order to keep the local oscillator on the needed frequency. The output signals of IC1 are fed to Q1 to provide a match between IC1's high-impedance output and the low-impedance input of FL1, a surface-acoustic-wave filter. Only the 45.75-MHz IF signal is passed through FL1 to IC2.

The heart of the unit is IC2, which contains a five-stage IF amplifier, a video detector, and the AFT circuit mentioned before. The video detector is tuned by C28 and L6, with L4 and L5 setting the operation of the limiter and AFT circuits. Note that R21 does not appear to be needed for operation of the circuit. If R21 is grounded (via TP1), the AFT circuit can be disabled if need be.

The automatic gain-control (AGC) circuitry is divided between IC4 and a portion of IC2. A square-wave between 25 and 35 kHz is generated by IC4, rectified by D2, and filtered by R14 and C17 to generate a negative-bias voltage of about -3.8 volts. The actual AGC level is created in IC2, and is set by R18. When a sufficiently strong video signal is fed to IC2, pin 12 starts to draw current through R12, grounding that point. The 1-volt level that would normally be at TP6 drops to about -3 volts. If needed, TP6 can be used to reduce the gain of an external downconverter unit. The AGC level set by R18 must be balanced so that the IF66 does not overload on strong signals, yet will not be low enough to drop the gain too soon on any external equipment connected to TP6.

TABLE 1
COIL WINDING DATA

L1	9½ turns
L2	9½ turns
L3	9½ turns
L4	5½ turns
L5	10½ turns
L6	7½ turns

Composite video at 2 to 3 volts peak-to-peak appears at pin 17 of IC2. The signal is buffered by Q2. The video and audio portions of the composite signal are separated by FL2 (which passes only the audio subcarrier) and FL3 (which traps the audio subcarrier and passes the video signal). Removing the audio subcarrier from the video signal prevents any sound-interference patterns from disturbing the final picture. The video signal is amplified by Q3; the final voltage level is set by R34. The video signal

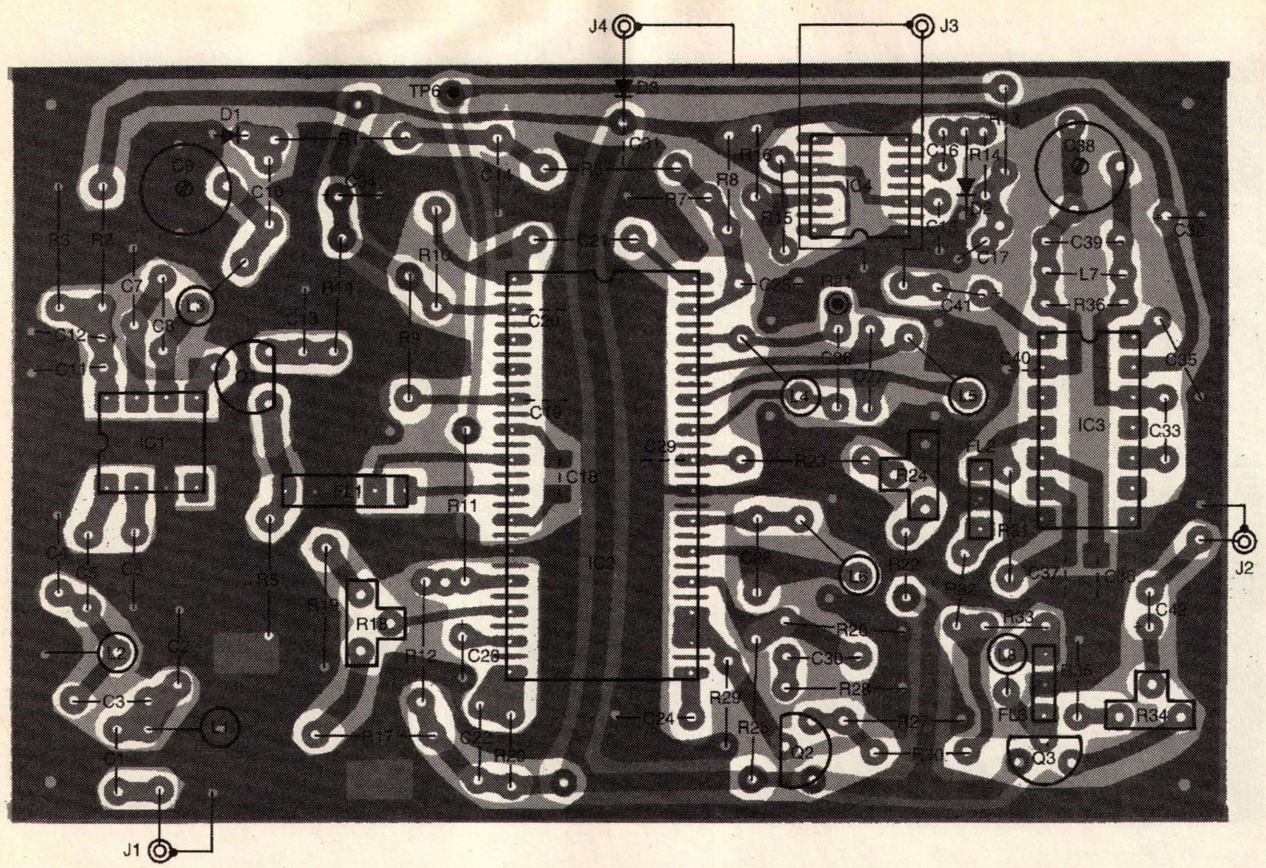


Fig. 5. Since the IF66 only differs from the IF44 in its input circuit, the layout of the two units is almost identical.

appearing on J2 is between 1- and 2-volts peak-to-peak across a 75-ohm load with a negative-going sync—a standard interface level.

The audio signal passed by FL2 is demodulated by IC3 since it is a frequency-modulated (FM) signal on a 4.5-MHz carrier. Within IC3 is an amplifier, a limiter, and a quadrature FM detector. Audio output appears at pin 1 and is passed to J3 through C41. The final audio level is 0.5 volts rms into a 5000-ohm line load. Those values work well with most audio amplifiers. Alignment of the entire audio circuit is done by C38; it is simply adjusted for the best-sounding signal.

The IF66's power supply is nominally 13.2-volts DC. At that voltage level, the current draw is about 180 mA. Protection diode D3 is included in case of an accidentally reversed supply polarity or negative transients that might damage the ICs. The supply-voltage tolerance is ±1 volt for best performance. Do not exceed 14.4 volts, and note that less than 11 volts might cause poor performance.

TABLE 2
IF44/IF66 TEST MEASUREMENTS

D3, C34 junction	+12.6 volts
IC2 pin 2	+12.6 volts
IC1 pin 8	+7.2 volts ±1 volt
Q1 emitter	+5.0 volts
Q3 emitter	+6.0 volts (depends on signal)
IC3 pin 13	+12.6 volts
IC3 pin 1	+6.0 volts (varies with C38)
IC4 pins 4, 8	+12.6 volts
R14, R13, C17 junction	–3.5 volts ±0.5 volts

The IF44. The schematic diagram for the 44-MHz IF unit, which we will call the IF44, is shown in Fig. 2. A careful examination of the two schematic diagrams in Figs. 1 and 2 will quickly show that the two units are similar. In fact, they are identical with the exception of the input circuit that passes the input signal from J1 to IC2. Therefore, we will only discuss that portion of the IF44.

The IF44 is designed to work with the standard 44-MHz carrier signal supplied by standard TV-tuner hardware. A bandpass filter circuit first filters the signal from J1; it is broadly tuned to a 40– to 47-MHz window. That frequency spread aids in rejecting any out of band frequencies that might be created by any hardware such as tuners or mixers that the IF44 is receiving its signal from. Transistors Q4 and Q1 then amplify the pre-filtered signal. Those transistors provide 23 dB of gain; R1 and R3 control the actual amount of gain. That amount of amplification will compensate for the gain loss that will come from the SAW filter. Beyond that input stage, the IF44 and IF66 are identical.

FM TV. The 70-MHz model uses a

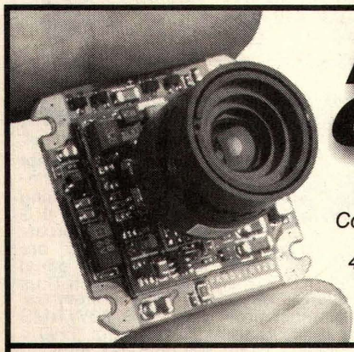
continued on page 83

SUPPLEMENT TO ELECTRONICS NOW MAY 1999

Electronic SHOPPER

R

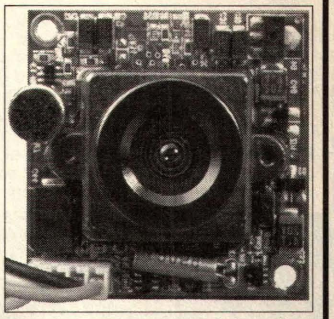
Micro Video Camera Sale



MB-45cB
Color Video Camera
2.8mm Lens
45° Angle of View
$99.95
Size: 1.25" sq.

Ask for the **Quick-Start KIT Accessory**

MB-650Ua
Black & White Video
Camera with Built-In
Audio & 4.3 mm Lens.
$89.95
Size: 1.18" sq.



Wireless Cameras

Wireless Camera Package Deals, include: one camera, one receiver and power supplies. (Receiver holds up to 4 cameras)

Wireless 4-Channel A/V Black/White & Color Cameras

Built-in Mic
(on All models)
Cameras are shipped with 4.3mm lens.
(Camera shown with optional lens.)

GFS-1001 (900MHz)
GFS-2002 (1.2Ghz)

Wireless Transmitter & Receiver

2.4 GHz
Video/Stereo Audio
ONLY
$219.95

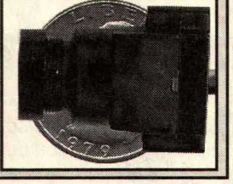
Dimensions: 2.5"(W) x 2.18"(H) x 3.28"(D)

Worlds Smallest Video Camera

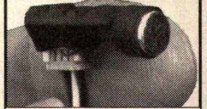
No Bigger than the size of a Quarter!
with CMOS Technology.

CM-550U *-$69.95*
Pinhole Camera Available:
CM-550P *-$69.95*

240 Line Horizontal Resolution
Size: 1.12"(L) .5"(W)



Micro Audio Receiver



- **Audio Jack** - RCA Female.
- **Power Jack** - 2.1 Female Barrel Jack.

MIC-300 *-$39.95*

Video Conferencing

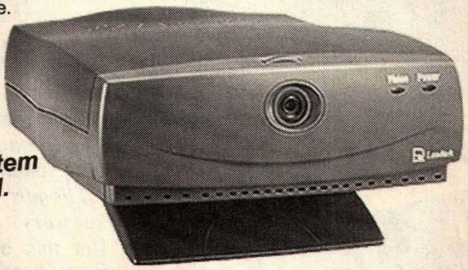
TeleEye has everything you need to do Color Video Conferencing. It comes with a built-in high quality digital camera, a high speed modem and state-of-the-art Audio/Video hardware.

Remote View Window
Up to 15 frames per second or VHS-quality resolution.

On-Screen Menus
Easy Control using your phone keypad.

$499.95

Stand Alone System
No PC Needed.



FREE Polaris Product Catalogs

LP-850p
$139.95

Length: 1.37"
Diameter: .87"

Outdoor Model Available $169.95

LP-850i
$129.95
Length: 1.9"
Diameter: .91"

Interfaces with existing Camera Systems!

System includes:
- Monitor
- Camera/100 ft. Cable
- Camera Stand/Mount
- 2-way Intercom Station
- 100 ft. Intercom Cable
- VCRInterconnect Cable
- One Year Warranty

SCO-1 *-$399.95*
Observation System

POLARIS affordable security solutions

Polaris Industries
http://www.polarisusa.com
800.752.3571
Polaris Industries 470 Armour Dr. Atlanta GA 30324 Tech Info: 404.872.0722 FAX: 404.872.1038

CIRCLE 222 ON FREE INFORMATION CARD

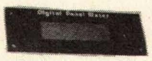
Mark V Electronics, Inc.

8019 E Slauson Ave
Montebello CA 90640
Free Catalog 323/ 888-8988
Fax 323/ 888-6868

DIY Audio Electronic Kits Enclosures & Transformers more than 60 items available!

ORDER 1-800-521-MARK
http://www.mark5co.com Email:mark5co@aol.com

3½ Digital LED Panel Meter #TY-43



Kit:$ ~~28.00~~ 15.00

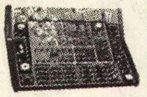
It is a precision A/D converter integrated circuit. The display is a 6" LED for high visibility. It is easy to assemble and use the meter as a voltmeter, ammeter, ohmmeter, thermometer, frequency counter or capacitance meter.DC±199.9mV full scale input 5-6VDC.

20 Color LED Audio Level Meter #TY-13

Asmb:$ ~~30.50~~ 9.99

Use this dual LED display indicating meter with your stereo power amplifier to indicate instantaneous speaker power. Operating range is -30dB to +5dB & can be calibrated to operate with 1-200W amplifiers. Not consume any amplifier power. A peak LED illuminates on overload!

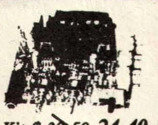
130-in-one Electronic Lab Kit #KA-902



$ ~~29.99~~ 19.99

Build your own AM broadcast station, electronic organ, timer, logic circuits... No special tools or soldering required due to premounted parts, pre-cut wires & simple coil-spring connectors. Requires 6 "AA" batteries.

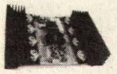
40W Mini Stereo Multi-Input Amp #TA-83



Kit:$ ~~30.50~~ 24.40

Operated from AC source as well as 12V DC car battery. Used as a microphone PA amplifier while simultaneously mixing with an auxillary input souce such as CD & MD player.

300W MOSFET Power Mono Amp #AF-3



Kit$ ~~165.00~~ 99.00

300W RMS into 4 ohms, 200W RMS into 8 ohms. Frequency response: 10Hz-20KHz. THD < 0.03%. S/N 91 dB. Input Sensitivity & Load impedance at 1KHz, 1V 47K & 4-16 ohm. Power Requirement: ±55V - ±65V DC at 8A(each channel). A speaker protection circuit which provides time delayed speaker turn on.

120W + 120W Pre & Main Stereo Amp

Kit:$ ~~67.92~~ 49.00
Asmb.:$ 86.95

It has provision for input program source switching, a phono pre-amp stage with RIAA equalization, 3-band tone controls, built-in power supply rectifier & filter & a speaker protection circuit. It only needs to be installed in a suitable housing & the addition of a power transformer in order to make it operational ***#TA-800MK2***

We accept Visa, MasterCard, Discover & Money Orders. Checks allow 2 weeks for clearance. We ship by UPS ground inside US(min $6.00) and ship by US mail outside US. Please call for orders shipping & handling or fax (foreign) orders. In business since 1985.

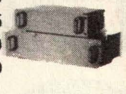
Clearance Sale...

#KA-901	30-in-one Electronic Lab kit	$ 6.99
#KA-903	Electronic Experiment kit	14.99
#KA-905	75-in-one Electronic Lab kit	12.99
#KA-906	300-in-one Electronic Lab kit	44.99

Metal Cabinets

Aluminium Front Panel

Best Buy



LG-1273	3x12x6¾"	$ 26.50
LG-1684	4x16x8"	32.50
LG-1924	4x19x11½"	38.25
LG-1925	5x19x11½"	42.00
LG-1983	2½x19x8"	35.25
LG-1923	3x19x11½"	36.50
LG-1927	7x19x11½"	52.50

LG- Black anodized rack cabinet

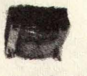
LL-1923B	2¾x19x12"	$ 69.50
LL-1925A	5x19x12"	79.50

**LL-Full Aluminum,Front .157" & other .078"*
**LL-Gold plated cap screw for front panel*

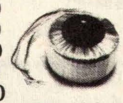
Power Transformer

Toroidal Transformers

#001	28/30Vx2	6A	$ 30.00
#002	36Vx2	3A	25.00
#003	40Vx2	6A	32.00
#004	24Vx2	6A	25.00
#005	26Vx2	3A	20.00
#006	18Vx2	5A	20.00
#007	53Vx2	8A	47.00
#008*	28/30Vx2	6A	42.00
#010	30/36Vx2	400mA	8.50
#011*	9Vx2	22A	62.00
#012*	33/42Vx2	6A	52.00



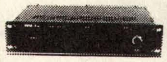
Transformer



**Toroidal Transformer*

60W + 60W Stereo Power Amp

#SM-302

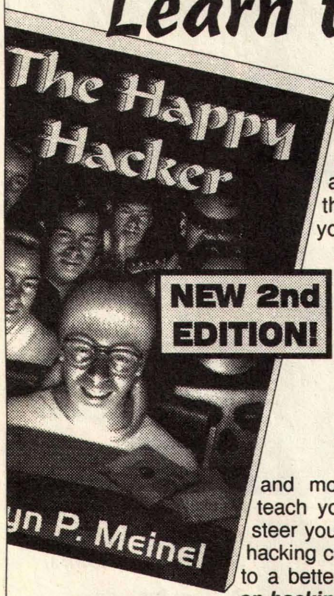


Kit $ ~~85.00~~ 69.00
Asmb $ 99.00

It provides 3 input jack pairs. One pair will accept a high impedance microphone. The 2 remaining pairs are for high level & low level input sources. These input jacks are selected by a panel mounted slide switch.Thus unit will operate effectively with all preamps. 60W per channel into 4 ohm RMS, 33W RMS per channel into 8 ohm. 20 to 20Khz. THD < 0.1%. Mic/Guitar 10mV 300 ohm-47K ohm.

CIRCLE 325 ON FREE INFORMATION CARD

Learn to Hack!



Finally, here is a no-nonsense technical book on computer hacking! In it you will learn how to hack computers you have physical access to and how to hack on the Internet. With this book, you will learn about:

Finding computers to hack
Breaking into computers
Hacking with Finger
Port surfing
Mapping the internet
Forging E-mail
Fighting spam
E-mail bombs
Hacker wars

and more! But this book will also teach you how to hack safely. It will steer you clear of the law, so that your hacking career won't lead to prison, but to a better job! ***By far, the best book on hacking available today!***

400 PAGE PAPERBACK, $34.95 SHIPPING $3

Call (800)719-4957 now!

to order (Visa/MC/COD) or call or write for **FREE CATALOG** of hard-to-get information about *computer viruses, computer hacking, security and cryptography*!!

Check our web site: ***www.logoplex.com/resources/ameagle***

American Eagle Publications, Inc.
P. O Box 1507, Dept E.
Show Low, AZ 85902

CIRCLE 270 ON FREE INFORMATION CARD

❖ ATTENTION ❖ CABLE VIEWERS

CABLE VIEWERS ... get back to your **BASIC** Cable Needs

Call 1-800-577-8775

For information regarding all of your **BASIC** cable needs.

5 GOOD REASONS

TO BUY OUR FAR SUPERIOR PRODUCT

- PRICE
- EFFICIENT SALES AND SERVICE
- WE SPECIALIZE IN 5, 10 LOT PRICING
- ALL FUNCTIONS (COMPATIBLE WITH ALL MAJOR BRANDS)
- ANY SIZE ORDER FILLED WITH SAME DAY SHIPPING

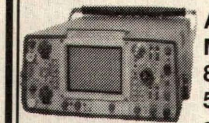
We handle NEW equipment ONLY -
Don't trust last years
OBSOLETE and UNSOLD stock!
COMPETITIVE PRICING - DEALERS WELCOME

BASIC
ELECTRICAL
SUPPLY &
WAREHOUSING
CORPORATION

It is not the intent of B.E.S.W. to defraud any pay television operator and we will not assist any company or individual in doing the same.
*Refer to sales personnel for specifications.

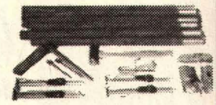
P.O. Box 8180 • Bartlett, IL 60103-8180 • 847-584-2099

TEKTRONIX 465M SCOPE



AN/ USM-425 militarized DC-100 MHz dual-trace oscilloscope with 8x10 CM display. Deflection 5 mv to 5 V/div in 10 calibrated steps, 1-2-5 sequence + vernier. Vertical modes: TRIG View, 20 MHz BW, CH 1, ALT, Add, Chop, CH 2 or X-Y. Sweep 0.05 usec to 0.5 sec/div in 22 steps + vernier; delay 0.05 usec to 50 msec/ div. Also X10 magnifier, adjustable handle, front cover and manual copy. Requires 100-132/200-264 V 48-440 Hz; 7x1.7x21.5, 32 lbs sh. USED-CHECKED, $475.00

30 FOOT MAST KIT



AB-1244/GRC MAST KIT, twelve aluminum alloy on steel sections form sturdy, yet lightweight 30 foot 1.7" dia mast. Kit includes five each lower and upper sections, one ea lower and upper adapter sections, gin pole swivel base, four ea 36 and 42 ft guy ropes, four guy stakes, two guy rings plus a 2.5 pound sledge hammer. Part of OE-254 antenna set; 30 lbs shpg NEW, $139.50

400 MHZ RADIOSONDE

VAISALA RS80 RADIOSONDE, ultra-light disposable transmitter (400 MHz approx) is designed to be carried aloft by weather balloon and transmit data for air temperature, barometric pressure and humidity to a ground station. Consists of circuit board, dipole antenna, and trailing wire. Requires 9 V battery. Cute experimenter item! 12.5"H as shown; 3 lbs sh.
NEW, $9.95 ea; 5 for $42.50

Prices F.O.B. Lima, Ohio. VISA, MASTERCARD, DISCOVER
Allow for shipping charges. Write for latest Catalog.
Address Dept. ES Phone 419/227-6573 FAX 419/227-1313
E-mail: fairadio@wcoil.com http://www2.wcoil.com/ ~fairadio

FAIR RADIO SALES

1016 E. Eureka Box 1105 Lima, Ohio 45802

LASERS

AT GREAT PRICES

Complete Ruby Laser Assembly less than $300
He-Ne Lasers, complete, for less than $50
American 60X Argon Lasers from $595
Laser Diode Modules from under $40
X-Y Scanners from $79

FREE CATALOG

- Helium-Neon
- Argon Lasers
- Diode Lasers
- Holography
- Books
- Ruby Lasers
- Scanners
- Lightshow Equipment
- Pointers
- Optics

Email: mlp@nlenx.com http://www.midwest-laser.com

Midwest Laser Products 30 Day Satisfaction Guarantee.
P.O. Box 262, Frankfort, IL 60423 VISA / MC Accepted
Phone: (815) 464-0085 FAX: (815) 464-0767

Real Beauties They Could be Yours

NETCOM since 1983

ICMaster
~~$195~~ Publisher

Bible of the IC Industry
Every Cross-reference
3 Volume Set with Tons of Information

with computer	alone	regular
$29 95 edition	$49	$69
$39 96 edition	$59	$89
$49 97 edition	$69	$109

Mega Sale ends soon

Oh-My-God !
buy a computer, get an **ICMaster** $29!

2 Easy payments of $199!
On Credit Cards only

Web CRUISER
Compaq LTE LITE 486 DX433

8.5" Active Matrix Display (Sharper & Brighter then standard display)
230m Standard Hard Drive -or- (810meg $29 option)
12M Ram / Internal 14.4k FAX Modem -and-
You can add an External 28.8k Modem for $19 -or-
External 33k Modem for $39
3.5 Floppy / All Standard Ports on rear
EJECTABLE: Battery & Ram
Power Supply / LIFETIME Compaq Tech Support
Internet Ready / Owners Manual Software & Win
Hydride Battery (2X the Power) $150 Value FREE

orig ~~$1,995~~

2 Easy payments of $288!
On Credit Cards only

CRUISER & Work Horse
Compaq LTE ELITE 486 DX475

9.5" Active Matrix Display (Sharper & Brighter than standard)
810m Standard Hard Drive -or- (1gig $29 option)
16M Ram Standard -or- (24M $39 option / 32M $59)
28.8k FAX MODEM -or- (33k option $25)
2-PCMCIA Expansion Slots & All Standard Ports
EJECTABLE: Battery , Hard Drive & Ram
Expandable & Upgradable / Lifetime Compaq Tech Support
Built-in Power Supply /Optional Compaq ELITE Case $29
Internet Ready / Owners Manual Software & W95
Hydride Battery (2X the Power) $150 Value FREE

orig ~~$2,695~~

2 Easy payments of $448!
On Credit Cards only

NETWORKREADY WORKSTSTION
Compaq LTE ELITE Pentium 90

10.5" ACTIVE Display (Sharper & Brighter)
24M Ram / 810 Meg Hard Drive / CD Rom
2-PCMCIA , Infrared , & All Standard Ports on rear w/ Mic
33 FAX-MODEM /Stereo Sound /LIFETIME Compaq Support
EJECTABLE: Battery, Hard Drive, Floppy, CD & Ram
Includes 2 Power Supplies (1 in Docking Station)
Internet Ready / Owners Manual Software & W95
Hydride Battery (2X the Power) $150 Value FREE

INCLUDES DESKTOP Docking Station
Converts your laptop to a desktop
2-PCMCIA Ports & 2-Bays for optional drives (any type!)
Stereo Speakers / Infrared Port / System Status Lights
2-types of Network connection RJ & Coax
Monitor Platform included

orig ~~$4,795~~

IBM Warrior

IBM Warrior
2 Easy payments of $399!
Credit Cards only
orig ~~$4,699~~

for HARSH ENVIRONMENTS
OUTDOOR DIRECT SUNLIGHT
Water Resistant !

Silione Rubberized & Diecast Case !
Ultra Shock Mounted 1GiG EIDE Hard Drive !
INSTANT ON ! ZERO BOOT UP TIME !!!!
PCMCIA , Serial & Parallel Ports in rear / 3.5 Floppy
16m Ram /1m Video/Local Bus 486-50 mhz & Math Co
28.8k Modem (Internet Ready), Speaker Phone
4+hours Battery Operation ! / Sound & Microphone
8.25" Display-256 Shade Monochrome REFLECTIVE
Touch Screen ***with*** Handwriting Recognition
Roxanne's Voice Annotates all Windows 3.X Functions
Unit Compatible with W95 / Optional 12V Car cord $29

Questions 843-650-5700 Intn' Orders netcomd@aol.com **10-9 EST**
Orders Only 800-733-3733 FAX 843-650-5777 **7 Days**

EARN MORE MONEY!

Be an FCC LICENSED

ELECTRONIC TECHNICIAN!

Earn up to $60 an hour and more!
Learn at home in spare time.
No previous experience needed!

No costly school. No commuting to class. The Original Home-Study course prepares you for the "FCC Commercial Radiotelephone License." This valuable license is your professional "ticket" to thousands of exciting jobs in Communications, Radio-TV, Microwave, Maritime, Radar, Avionics and more...even start your own business! You don't need a college degree to qualify, but you do need an FCC License.

No Need to Quit Your Job or Go To School
This proven course is easy, fast and low cost! GUARANTEED PASS—You get your FCC License or money refunded. **Send for FREE facts now. MAIL COUPON TODAY!**

Or, Call 1-800-932-4268 Ext. 210

COMMAND PRODUCTIONS
FCC LICENSE TRAINING, Dept. 210
P.O. Box 2824, San Francisco, CA 94126
Please rush FREE details immediately!

NAME ______________________
ADDRESS ______________________
CITY ______________ STATE ______ ZIP ______

PIC'n Books

LEARN ABOUT PIC MICROCONTROLLERS

EASY PIC'n - Beginner $29.95

PIC'n Up The Pace - Intermediate $34.95

NEW!

PIC'n Techniques - Intermediate $34.95
- 8-pin PICs
- Timer 1, timer 2 and the capture/compare/PWM (CCP) module
- Talking to a PIC with a PC using a terminal program
- Test equipment and data logger experiments

See Table Of Contents: http://www.sq-1.com
Secure Online Ordering Is Available

+ $4 s/h in US for 1 book, $5 for 2 books, $6 for 3 books
VISA, MC, AMEX, MO, Check
CA residents please add 7.25% CA sales tax
PIC and MPLAB are trademarks of Microchip Technology Inc.

SQUARE 1 ELECTRONICS

P.O. Box 501, Kelseyville, CA 95451
Voice (707) 279-8881 FAX (707) 279-8883
Web Site: http://www.sq-1.com
E-Mail sqone@pacific.net

Digital Power Meter

Measures
Watts
& Watt-hours
(kW-hr)

**Simple to use.
Plug the Power Meter into any AC outlet, and plug the appliance to be measured into the Power Meter. That's it!**

Model 4-1850:
- Measure REAL ("true") power 1 to 1850 Watts
- Measure Power used, 1 Watt-hour to 9999 kilo-Watt-hr
- Measure power cost ($), just enter cost per kilo-Watt-hr

New! RS-232 Interface
features data logging, on-screen measurement, display and analysis. Can be added to either model, only $50!

Model 20-1850 does everything the 4-1850 with these additional features: Irms, Vrms, Power Factor, 20 mhz processor and more!

Model 4-1850 Only $149.95 Delivered!
Model 20-1850 Only $249.95 MC/Visa/MO/Check

Custom applications available • Dealer inquires welcome

Brand Electronics,
421 Hilton Rd.
Whitefield, ME 04353
For information only, call 1-207-549-3401
email: ebrand@mint.net

Call today! To order, call toll free, 24 Hrs.
1-888-433-6600
http://www.mint.net/~ebrand/

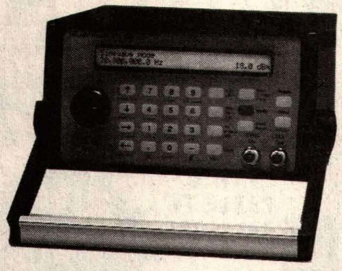
Any waveform you want!

New Features:

✔ 21.5 MHz

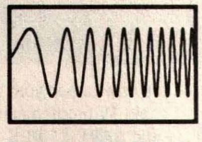
✔ .01 Hz steps

✔ multi-unit phaselock

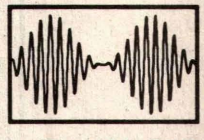


Telulex Inc. model SG-100A

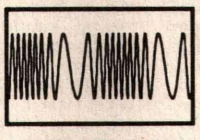
- **Synthesized Signal Generator**
  Clean sinewaves DC-21.5 MHz, .001% accuracy!
  .01 Hz steps. DC Offset. RS232 remote control.
- **Arbitrary Waveform Generator**
  40 Megasamples/Second. 32,768 points. 12 bit DAC
- **Function Generator**
  Ramps, Triangles, Exponentials & more to 2 MHz!
- **Pulse Generator**
  Digital waveforms with adjustable duty cycle



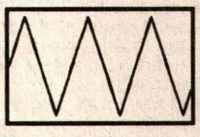
DC to 21.5 MHz linear and log sweeps



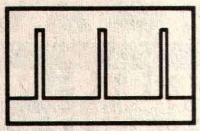
Int/Ext AM, SSB, Dualtone Gen.



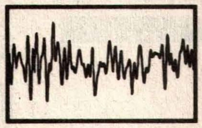
Int/Ext FM, PM, BPSK, Burst



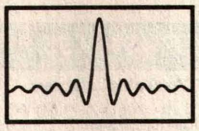
Ramps, Triangles, Exponentials



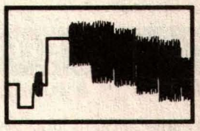
Pulse Generator



Noise



Arbitrary Waveforms



Unlimited Possibilities!

Telulex Inc.

2455 Old Middlefield Way S **Tel** (650) 938-0240 **http://www.Telulex.com**
Mountain View, CA 94043 **Fax** (650) 938-0241 Email: sales@Telulex.com

CIRCLE 312 ON FREE INFORMATION CARD

INTERNET SECURITY

The latest tricks and methods hackers use on the Net to pirate software (warez), and hack websites. Includes examples, countermeasures, **password defeats**, Packet-Switched Networks, UNIX, Sprintnet, X.25, anonymous FTP, brute force techs, lots of tips. *More! $29*. wrds=29.4K

INTERNET TRACKING & TRACING: Scammers, spammers, stalkers, infectors, and others hide behind the Internet's anonymity to commit serious offenses. Learn from master hackers best methods to track, trace IDs and origins, and to protect your own privacy. *More! $29*. wrds=17.0K

INTERNET FRAUDS DATABOOK: Internet cons, scams and related frauds now rake in $2+Billion annually! Most are done anonymously with impunity. Details how they're done, how to ID them, how to protect yourself. *More!* **$25**. wrds=19.1K

THE COOKIE TERMINATOR: Many websites track your every move! Browser cookie, history and cache files contain personal data readily accessible to Internet predators, scammers, spammers and snoops. Your financial, medical, political, habits, lifestyle, future plans data is exposed to the world! Step-by-step how to remove and stop cookies from destroying your privacy. **$25**. wrds=8.4K

Any 2 for $49, 3 for $64, all 4 for $79!

PBX SECURITY

PBXs hacking losses of $5-$10 Billion/yr! Detailed vulnerabilities (especially for out-dial), countermeasures. Exclusive author interview in Forbes! **$24**. wrds=17.4K

ATM SECURITY

100+ ATM crimes, abuses, vulnerabilities, defeats exposed - TEMPEST, mag stripes, false fronts, supercool, *More!* Case histories, labeled internal photos, figures. **$39**. wrds=41.0K

CELLPHONE/CORDLESS GUIDE

How cellphones operate; mods. Vulnerabilities to hack attack; countermeasures. Cloning details for NAMs, ESNs, etc, control data formats, computing encoded MINs, ESNs, SIDHs, Op Sys, PROMs, forcing ACK, test mode and resets, cable diagrams, scanning, tracking, scanner restorations, freq allocations, roaming, step-by-step to keypad-reprogram 100+ popular cellphones. One FREE database search. Plus much on Cordless phones. *More! $49*. wrds=80.0K

PAGER (BEEPER) MANUAL: How Pagers work, different types and uses, freqs, advantages over and uses with cellphones, and tips and tricks. How phreaks hack Pagers; countermeasures. Plus plans for a Personal Pocket Paging System (xmitter and receiver). *More! $29*. wrds=11.7K

Both for only $69!

CALLER ID & ANI SECURITY

How they work and the many vulnerabilities of Caller ID, ANI, *69, *57, Call Blocking, *67, et al. Describes ESS, SS7, CN/A, CAMA, DNR, Diverters, Centrex! **$25**. wrds=15.2K

FAX MACHINE SECURITY

All known methods used to hackFaxes and countermeasures. Includes computer fax modems, crimes, interceptions, fax servers, fax-on-demand, protocols, parameters, compression, encryption, and fax surveillance-type mods. *More!* **$29**. wrds=28.0K

VOICE MAIL SECURITY

VMSs are hacked to penetrate PBXs to make outgoing calls, get free VMB usage, secretly read/change/delete messages, control or damage the VMS (or its PBX) itself. Details how hackers do it, countermeasures. A must for users, sysops, security personnel! **$29**. wrds=14.2K

STOPPING POWER METERS

As reported on "60 MINUTES"! 6th Edition! Details devices that can slow down (even stop) power meters while loads draw full power - great science projects! Devices plug into one outlet and normal loads into other outlets. Describes meter creep, overload droop, pole meters, etc. **$29**. wrds=10.4K

SPM THE VIDEO: Now its easier to learn about KW-HR Power Meters than ever before! This educational video shows you how they work and their anatomy. Demonstrates SPMEM device and external magnetic methods used to slow and stop meters! Hosted by a top expert in the field. From the novice to the pro, an excellent source of info on these exciting devices! Great in combo with our SPM-related manuals! **$29**. (20 min)

THE I.G. MANUAL: Details external magnetic ways (applied to meters) outlaws use to slow down and stop power meters while drawing full loads. **$25**. wrds=4.9K

KW-HR METERS: How watt-hour energy meters work, calibration, error modes (many), ANSI Standards, etc. **Demand and Polyphase Meters.** Experimental results to slow, stop power meters by others. **$25**. wrds=24.2K

Any 2 for $49, 3 for $64, all 4 for $79!

COMPUTER SECURITY

Describes in detail how computers penetrate each other, and how VIRUSES, TROJAN HORSES, WORMS are implemented. Dozens of computer crime and abuse methods and countermeasures. Includes disk filled with hacker text files and utilities, and the legendary **FLUSHOT+** protection system. Internet advice, password defeats, glossary - *much more*! Manual + PC Disk! *$39*. wrds=49.5K

THE HACKER FILES: Expose´ 3 HD PC disks filled with choice raw, colorful, highly informative hacker, phreaker text files covering many topics! *$39*.

Both for only $69!

BEYOND VAN ECK TEMPEST

Remote eavesdropping plans of TV video "noise" signals. Range up to 1 KM. Describes how van Eck systems work, and are also used in surveillance of computer systems. Plus TVRO vs phone privacy detailed! **$29**. wrds =14.9K. Van Eck Demo Tape is $29. (15 min). Both for only $49!

MANY MORE TITLES!

(See Catalog for prices & descriptions)
BEYOND PHONE COLOR BOXES
ANSWER. MACHINE SECURITY
CASINO SECRETS
CHECK & M.O. SECURITY
CREDIT CARD SECURITY
CONS & SCAMS DATABOOK
SOCIAL ENGINEERING
POLYGRAPH SECRETS
BY AN ORDER OF THE MAGNITUDE
ULTIMATE SUCCESS MANUAL
STEALTH TECHNOLOGY
SIMPLE/CHEAP SECURITY ELEC.
SECRET & SURVIVAL RADIO
THE "GOLDFINGER"
THE "SILKWOOD"
SECRETS OF SOLDERLESS BBS
HIGH VOLTAGE DEVICES
MIND CONTROL
UNDER ATTACK!
RADIONICS MANUAL
HEAL THYSELF!
SECRET & ALTERNATE IDS
CRYPTANALYSIS TECHNIQUES
GOVERNMENT LAND GRAB
ROCKET'S RED GLARE
SURVIVAL GUNS & AMMO
THE ULTIMATE DRIVER

THE DIRTY-2 DOZEN!

24+ *Hot* Hack/Phreak Expose´ Disks!

See **CATALOG!**

SPECIAL PROJECTS

We will design & build just about anything electronic! Hardware done as **SPECIAL PROJECTS**. Send #10 SASE or $1 for SP Application Form, else get at: www.tsc-global.com/spaf-spp.html

TOP SECRET **CONSUMERTRONICS** CATALOG $1 WITH ORDER, $3 W/O

2430 Juan Tabo, NE, #259, ABQ, NM 87112
P.O. Box 23097 ABQ, NM 87192
Fax: 505-292-4078 (all hours, orders only) Voice: 505-237-2073 (9-7, M-S)

Full Web Catalog: www.tsc-global.com Special Projects: .../spaf-spp.html

Established in 1971 by John Williams, MSEE, former DOD weapons engineer and NIH physicist. Featured on CBS "60 Minutes," Forbes, New York Times. Add $5 total S/H (US, Canada). Postal MO is fastest! VISA, MC OK. No CODs. 10% OFF all Orders over $100; $2.00 OFF all New Orders over $20 placed by Mail or Fax. wrds=Estimated Word Count

Sold for legal educational purposes only. Some publications are controversial! We take no responsibility for anything we publish. See Catalog for WARRANTY, SPECIAL PROJECTS and all other applicable policies.

CIRCLE 226 ON FREE INFORMATION CARD

ABC ELECTRONICS 315 7TH AVE N. MPLS. MN. 55401
(612)332-2378 FAX (612)332-8481 E-MAILSURP1@VISI.COM
WE BUY TEST EQUIPMENT AND COMPONENTS.
VISIT US ON THE WEB AT WWW.ABCTEST.COM

HP 54501A 100MHZ DIGITIZING SCOPE	$1300.00	HP 4935A TRANS.IMPAIRMENT TEST SET	$900.00
HP 54201D 300MHZ DIGITIZING SCOPE	$1000.00	HP 5006A SIGNITURE ANALYZER	$150.00
HP 54201A 300MHZ DIGITIZING SCOPE	$1000.00	HP 86602B 1MHZ-1300MHZ RF PLUG	$400.00
HP 54200A 50MHZ SCOPE/WAVEFORM ANALYZER	$700.00	EIP 575 MICROWAVE COUNTER	$1500.00
HP 3312A 13MHZ FUNCTION GENERATOR	$250.00	FLUKE 95 50MHZ SCOPEMETER	$550.00
HP 5370A 100MHZ U.T.I. COUNTER	$400.00	LECROY 7200 400MHZ O-SCOPE	$1000.00
HP 3586C LEVEL METER	$750.00	TEK 475 200MHZ O-SCOPE	$500.00
HP 436A POWER METER W/O SENSOR&CABLE	$500.00	TEK 465 100MHZ O-SCOPE	$400.00
HP 8350B SWEEP OSCILLATOR MAINFRAME	$2000.00	TEK 496P 1KHZ-1.8GHZ SPEC.ANALYZER	$3500.00
HP 3437A 3.5DIGIT SYSTEM VOLT METER	$250.00	TEK 1240 LOGIC ANALYZER	$750.00
HP 3455A DIGITAL MULTIMETER	$250.00	TEK TDS320 100MHZ DIGITAL O-SCOPE	$1400.00
HP 3456A DIGITAL MULTIMETER	$400.00	TEK 11401A 500MHZ PROG.0-SCOPE FRAME	$750.00
HP 3336C SYNTHESIZER/LEVEL GENERATOR	$800.00	TEK 7854 400MHZ OSCILLOSCOPE FRAME	$500.00
HP 3325A SYNTHESIZER/FUNCTION GENERATOR	$1000.00	TEK 7904 400MHZ OSCILLOSCOPE FRAME	$250.00
HP 5335A 200MHZ COUNTER	$600.00	TEK 7A26 200MHZ VERTICAL PLUG	$75.00
HP 8165A PROGRAMMABLE SIGNAL SOURCE	$1100.00	TEK 7A24 400MHZ VERTICAL PLUG	$150.00
HP 8558B/181 100K-1500MHZ SPECTRUM ANALYZER	$1000.00	TEK 7B80 400MHZ TIME BASE	$75.00
HP 8559B/183 10MHZ-21GHZ SPECTRUM ANALYZER	$3000.00	TEK 7B92A 500MHZ DUAL TIME BASE	$125.00
HP 1740A 100MHZ OSCILLOSCOPE	$250.00	TEK 7S12 SAMPLING PLUG	$250.00
HP 6034A 60VDC-10A POWER SUPPLY	$750.00	TEK 7L14 10KHZ-1.8GHZ SPEC. ANALYZER	$1000.00
HP 6269B 40VDC-50A POWER SUPPLY	$800.00	TEK AM503 CURRENT PROBE AMPLIFER	$250.00
HP 6553A 40VDC-12.5A. POWER SUPPLY OPT.J01	$1200.00	WAVETEK 145 20MHZ PULSE/FUNCTION GEN.	$400.00
HP 6632A 20VDC-5A POWER SUPPLY	$500.00	WAVETEK 182A 4MHZ FUNCTION GEN.	$150.00
HP 6643A 45VDC-4.3A POWER SUPPLY OPT.J03	$750.00	WAVETEK 955 7.5-12.4GHZ MICROSOURCE	$1100.00

BEST DEALER PRICING!

CABLE DIRECT

CONVERTERS • FILTERS DESCRAMBLERS

IMPROVE YOUR IMAGE WITH VIDEO STABILIZERS

FREE CABLE TV CATALOG!

100% MONEY BACK GUARANTEE!

30 DAY FREE TRIAL!

Now you can tune-in your favorite cable TV programming and **SAVE $100'S - EVEN $1000'S** on premium **CABLE TV EQUIPMENT.**

VISA • MasterCard

MODERN ELECTRONICS

1-800-906-6664

2609 S. 156TH CIRCLE • OMAHA, NE 68130
http://www.modernelectronics.com

EZ-EP DEVICE PROGRAMMER - $169.95

Check Web!! -- *www.m2l.com*

Fast - Programs 27C010 in 23 seconds
Portable - Connects to PC Parallel Port
Versatile - Programs 2716-080 plus EE and Flash (28F,29C) to 32 pins
Inexpensive - Best for less than $200

- Correct implementation of manufacturer algorithms for fast, reliable programming.
- Easy to use menu based software has binary editor, read, verify, copy, etc. Free updates via bbs or web page.
- Full over current detection on all device power supplies protects against bad chips and reverse insertion.
- Broad support for additional devices using adapters listed below.

Available Adapters

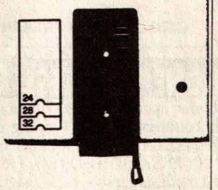
EP-PIC (16C5x,61,62x,71,84)	$49.95
EP-PIC64 (62-5,72-4)	$39.95
EP-PIC12 (12C50x)	$39.95
EP-PIC17 (17C4x)	$49.95
EP-51(8751,C51)	$39.95
EP-11E (68HC11 E/A)	$59.95
EP-11D (68HC711D3)	$39.95
EP-16 (16bit 40pin EPROMS)	$49.95
EP-Z8(Z86E02,3,4,6,7,8)	$39.95
EP-SEE2 (93x,24x,25x,85x)	$39.95
EP-750 (87C750,1,2)	$59.95
EP-PEEL(ICT22v10,18v8)	$59.95
EP-1051(89C1051,2051)	$39.95
EP-PLCC (PLCC EPROMs)	$49.95
EP-SOIC (SOIC EPROMs)	$49.95

Many Other Adapters Available

M²L Electronics

970/259-0555 Fax: 970/259-0777
361 S Camino Del Rio Suite #119; Durango, CO 81301; CO orders add 7% sales tax.
http://www.m2l.com

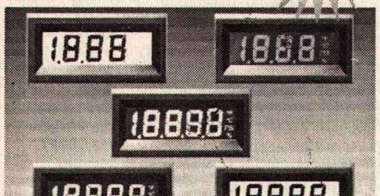
EZ-EP
M²L ELECTRONICS
Los Angeles, California



Introducing...

The Epic Series

NEW



280 different configurations in a single size, snap-in mounted case

Create a look of conformity on panels

Choose from:

- ▼ 3 1/2 or 4 1/2 digit displays
- ▼ voltage or process loop inputs
- ▼ black, red, amber or green numerals
- ▼ black numerals with lighted green background

Features:

- ▼ selectable, displayed engineering units
- ▼ resistant to RF and EMI
- ▼ economically priced
- ▼ five year warranty

MasterCard • VISA

Visit our catalog on the web: **www.knsinstruments.com**

KNS Instruments

800-356-4920

PO Box 10158
Bedford, NH 03110-0158
Fax 800-356-1250

VIDEO SYNC GENERATOR

Restores Horizontal and Vertical Sync Lines from Distorted Video

Lost Sync

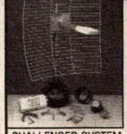
Restored Sync with VSG

For Free Information Package and Pricing

VISA • MasterCard

Call (219) 233-3053
www.south-bend.net/rcd

R.C. Distributing, PO Box 552, South Bend, IN 46624



CHALLENGER SYSTEM
31-Channel Complete $240
Other Systems Available
5 Year Warranty
FREE SHIPPING

Quality Microwave TV Systems

WIRELESS CABLE - IFTS - MMDS
ATV - INTERNATIONAL - DIGITAL
Amplifiers • Antennas • Books • Components

- RF Frequency 2100-2700 MHz
- SASE For ***"FREE"*** Catalog or Send $1

PHILLIPS-TECH ELECTRONICS

P.O. Box 13074 • Scottsdale, AZ 85267-3074
CATALOG/INFO: 602-947-7700
ORDER LINE: 800-880-MMDS
FAX LINE: 602-947-7799
WEBSITE: www.phillips-tech.com
E-MAIL: product@phillips-tech.com
Visa • M/C • AmEx • Discovery • COD's • Quantity Pricing

MECI

340 East First Street
Dayton, Ohio 45402

Your Electronics Value Company

Tons of Electronics

Get your FREE catalog today and discover some of the best deals in electronics. We have thousands of items ranging from unique hard-to-find parts to standard production components. Call, write or fax today to start your subscription to one of the most unique catalogs in the industry, filled with super values on surplus electronic and hobbyist type items.

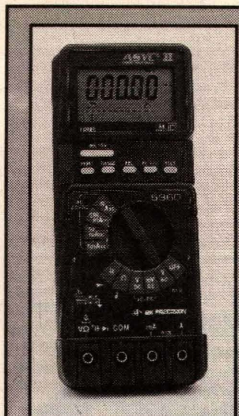
Checkout our 10,000 item on-line catalog http://www.meci.com

Order Toll Free
1-800-344-4465

Why pay more? Call today!

Fax Order Line
1-800-344-6324

CIRCLE 251 ON FREE INFORMATION CARD



BK PRECISION®

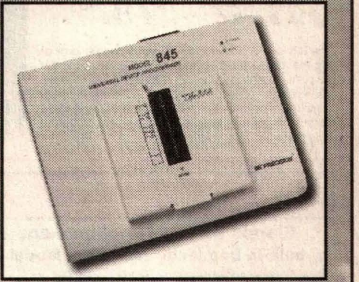
The 5300 Series, one of the world's finest digital multimeters. The best of the ASYC II Series, it has the best accuracy, a built-in counter, and displays AC voltage as resistive power or dB (impedance selectable), saving you the time of making the calculation. A careful examination of the performance features and user-conscious design will tell you that you hold a superior DMM in your hand, designed with measurement capability needed by users who demand the best.

MFG	MODEL	ACC'Y	LIST	SPECIAL PRICE
B&K	5360/MX53B	0.1%	$229.00	***$129.00***
B&K	5380/MX55	0.025%	$309.00	***$139.00***
B&K	5390/MX56B	0.025%	$325.00	***$149.00***

(resistive power on model #5390/MX56B)

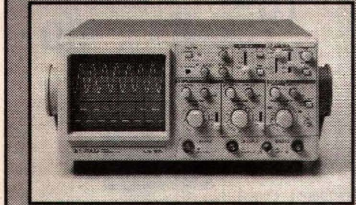
- meters made in France by Metrix for B&K, feature 50,000 count capability, bargraph, true RMS, mains disturbance indication, good transient protection, a wide temperature range, conform to IEC 1010 class 2 safety compliance & 3 year warranty

Universal Device Programmer & Logic IC Tester Model #845

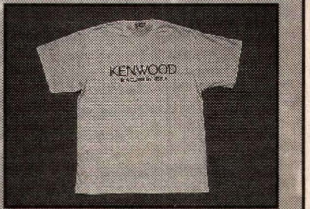


The 845 is a software expandable universal device programming workstation that supports a wide variety of programmable devices with the added capability to test digital ICs. It is the most sophisticated low-cost programmer available today. A unique hardware/software architecture enables the Model 845 to easily grow in support and engineering software design capabilities as quickly as your device library requirement. State-of-the-art universal programmer offers you the most advanced programming facilities with the most user-friendly interface. Since each pin is software addressable, new part numbers can be added to the list of supported devices through software upgrades. The 845 interfaces with IBM, PC, XT, PS/2, AT, 386, 486, Pentium, portable or compatible personal computers. The standard pack-age allows you to directly connect to your PC through any standard parallel printer port (no special interface card or special modules needed).

MODEL	DESCRIPTION	REGULAR	SALE
840	Eprom Programmer (single socket)	205.00	192.95
841	Eprom Gang Programmer (4 sockets)	260.00	251.95
842	Universal Programmer	695.00	611.95
843	Universal Programmer (parallel port interface)	795.00	699.95
845	**Universal Programmer (parallel port interface) Windows based**	**1295.00**	**1139.95**
846	Universal Programmer (parallel port interface)	495.00	435.95
847	Universal Programmer (4 sockets, parallel port interface)	595.00	523.95



KENWOOD



MODEL CS-4125

20 MhHz, 2 Channel Oscilloscope, with probes & 3 year warranty

Suggested Price $595.00

SUPER SPECIAL $389.00 w/free t-shirt!!!

MODEL	DESCRIPTION	REGULAR	SUPER SALE PRICE
CS-4135	40 MHz, 2 CH, 12 kV CRT w/scale illumination, 3 year warranty	855.00	***685.00 w/free Kenwood t-shirt!***
CS-5350	50 MHz, 3 CH, Delayed Sweep, w/Readout & Cursors, 3 year warranty	1650.00	***1235.00 w/free Kenwood Sweatshirt!***
CS-5355	50 MHz, 3 CH, Delayed Sweep, 3 year warranty	1485.00	***1115.00 w/free Kenwood Sweatshirt!***
CS-5370	100 MHz, 3 CH, Delayed Sweep, w/Readout & Cursors, 3 year warranty	2035.00	***1525.00 w/free Kenwood Sweatshirt!***
CS-5375	100 MHz, 3 CH, Delayed Sweep, 3 year warranty	1815.00	***1360.00 w/free Kenwood Sweatshirt!***

Electronic Training Videos From UCANDO

MODEL	DESCRIPTION	REGULAR	SALE
VT401	AM Radio: Major stages of AM, signal conversion, signal detection, audio reproduction, AM stereo. 61 Minutes	44.95	39.95
VT402	FM Radio Part 1: Bandwidths, RF amplifier, mixer-oscillator, IF amplifier, limiter FM detector. 58 Minutes	44.95	39.95
VT404	TV Part 1, Intro to TV: Gain an overview of the television system and how the stages work together. 56 Minutes	44.95	39.95
VT405	TV Part 2, The Front End: UHF-VHF tuning stages, automatic fine tuning, remote control. 58 Minutes	44.95	39.95
VT406	TV Part 3, Audio: The sound strip, stereo TV, secondary audio programming, professional channels. 57 Minutes	44.95	39.95
VT501	Understanding Fiber Optics: Basic fundamentals, cable design, connectors, couplers, splicing. 58 Minutes	44.95	39.95
VT502	Laser Technology: Laser theory, types of lasers, applications, safety precautions. 57 Minutes	44.95	39.95

SAVE EVEN MORE!
Buy any six videos for only $216.00. Order your UCANDO videos today!

PRINT™
Products International

Call, fax or email today for complete specs on any of the above products, and a copy of our 84 page test and measurement instrument catalog

8931 Brookville Rd * Silver Spring, MD, 20910
800-638-2020 * Fx 800-545-0058 * www.prodintl.com * sales@prodintl.com

CIRCLE 264 ON FREE INFORMATION CARD

CALL TOLL FREE
(800) 292-7711
Orders Only
Se Habla Español

C&S Sales

Excellence in Service

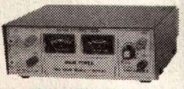
Look For Other
Monthly Specials
On Our Website
www.cs-sales.com

Power Supplies

Elenco Quad Power Supply

Model XP-581

$79.95



4 Fully Regulated DC Power Supplies in One Unit

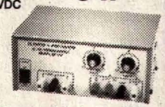
4 DC voltages: 3 fixed - +5V @ 3A, +12V @ 1A, -12V @ 1A
1 Variable - 2.5 - 20V @ 2A

Elenco Power Supply Kit

Model XP-720K

$54.95

- 1.5VDC - 15VDC @ 1A
- --1.5VDC - --15VDC
- 5VDC @ 3A
- 6.3VAC @ 1A & 12.6VAC center tapped @1A



XP-720 Fully Assembled **$85**

Elenco DC Power Supply

Model SPL-603
3A 0-30VDC

$79.95

The SPL-603 is a solid-state DC power supply providing the exact output voltage no matter what current you use. It contains one fully regulated power supply. The variable voltage is capable of delivering 0-30V at up to 3A. The output is precisely held to the desired output voltage by a special regulating circuit. Output fully protected from overload.

Miscellaneous

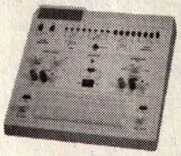
Elenco Model EP-50

Electronic Playground and Learning Center Contains Over **50** Experiments

$19.95

Elenco Model XK-150

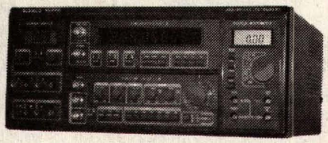
Digital/Analog Trainer



$89.95

Ideal for Schools

Elenco Model MX-9300
Four Functions in One



$450

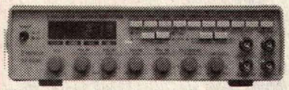
Features:

- One instrument with four test and measuring systems:
  - 1.3GHz Frequency Counter
  - 2MHz Sweep Function Generator
  - Digital Multimeter
  - Digital Triple Power Supply - 0-30V @ 3A, 15V @ 1A, 5V @2A

Generators & Counters

Elenco Sweep Function Generator

w/ built-in frequency counter Model GF-8036

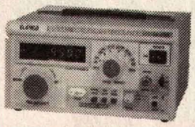


$225

This sweep function generator with counter is an instrument capable of generating square, triangle, and sine waveforms, and TTL, CMOS pulse over a frequency range from 0.2Hz to 2MHz.

Elenco RF Generator with Counter

(100kHz - 150kHz) **Model SG-9500**



Features internal AM mod. of 1kHz, RF output 100MV - 35MHz. Audio output 1kHz @ 1V RMS.

$225

SG-9000 .... $119.95
(analog, w/o counter)

10 Function 1.3GHz Universal Counter

Elenco Model F-1300

- Frequency .05Hz - 1.3GHz 3 Ranges
- Period - Can read 60Hz to 60.000000 F=1/T
- Totalize - Counts to 199,999,999
- RPM - 3 to 2099994 RPM
- Duty Cycle
- Max/Min/AVG with Time
- Stop-watch set .2 sec. to 100 hrs.
- Math Functions
- Timer - 2 sec. to 99 days
- Pulse Width - 0.1ms to 66666.6ms

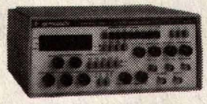
$225

B&K 20MHz Sweep/Function Generator with Frequency Counter

Model 4040

- 0.2Hz to 20MHz
- AM & FM modulation
- Burst Operation
- External Frequency counter to 30MHz
- Linear and Log sweep

$399



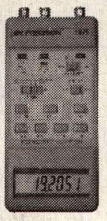
10MHz Model 4017	**$309**
5MHz Model 4011	**$249**

BK PRECISION

Multifunction Counter

B&K Model 1875

10Hz - 2.5GHz



$189

Ultra sensitive synchronous detector bar-graph and RF strength.

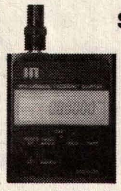
3 Channels

Measures Frequency, Period, Data Hold, Relative, Memory (min., max., average). High Sensitivity, Microprocessor Controlled.

Elenco Handheld Universal Counter

10Hz - 2.8GHz

Model F-2800



$99

Features 10 digit display, 16 segment and RF signal strength bar-graph.

Includes antenna, NiCad battery, and AC adapter.

Kit Corner

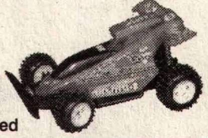
over 100 kits available

Model AK-870

Radio Control Car Kit

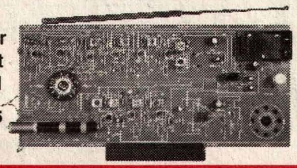
$24.95

- **Solderless**
- 7 Functions
- Radio Control Transmitter Included



Model AM/FM-108K

AM/FM Transistor Radio Kit w/ Stand



$29.95

Model AK-700

Pulse/Tone Telephone Kit

Ideal School Project

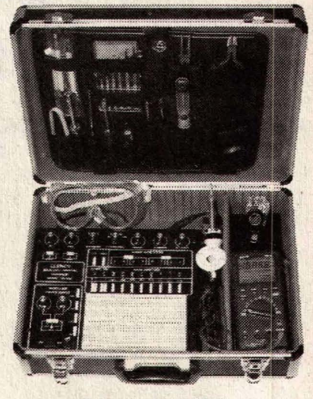
$15.95

Elenco Digital / Analog Trainer

Model XK-700

Elenco's newest advanced Digital / Analog Trainer is specially designed for school projects. It is built on a single PC board for maximum reliability. It includes 5 built-in power supplies, a function generator w/ continuously sine, triangular and square waveforms, 1,560 tie point breadboard area. Tools and meter shown optional. (Mounted in a professional tool case made of reinforced metal).

XK-700 Assembled & Tested	XK-700K - Kit
$189.95	**$159.95**



Made in USA

Guaranteed Lowest Prices

UPS SHIPPING: 48 STATES 5%
OTHERS CALL FOR DETAILS
IL Residents add 8.25% Sales Tax

C&S SALES, INC.

150 W. CARPENTER AVENUE
WHEELING, IL 60090
FAX: (847) 541-9904 (847) 541-0710

15 DAY MONEY BACK GUARANTEE
2 YEAR FACTORY WARRANTY

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CIRCLE 322 ON FREE INFORMATION CARD

SAME DAY SHIPPING

C&S Sales

Excellence in Service

CALL OR WRITE FOR OUR FREE 64 PAGE CATALOG!
(800) 445-3201

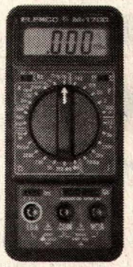
Digital Multimeters

Elenco LCR & DMM
Model LCM-1950

12 Functions
Freq. to 4MHz
Inductance
Capacitance
and Much More

$69

Elenco Model M-1740

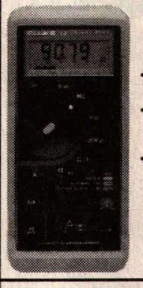


$39.95

11 Functions:
- Freq. to 20MHz
- Cap. to 20μF
- AC/DC Voltage
- AC/DC Current
- Beeper
- Diode Test
- Transistor Test
- Meets UL-1244 safety specs.

Model M-2760 - $24.95
(9 functions)

Fluke 79III



$185

- Capacitance ranges from 99.99nF to 9999μF.
- Built-in frequency counter of voltage input from 1Hz to over 20kHz.
- Lo-Ohms range, a 40Ω range with Fluke's proprietary Zero Calibration, offers 0.01 resolution with increased noise rejection.

Series II (limited qty.)
$179

Fluke 87III

$299

Features high performance AC/DC voltage and current measurement, frequency, duty cycle, resistance, conductance, and capacitance measurement.

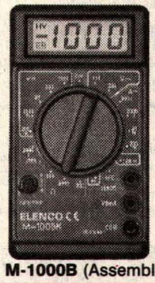
Series II (limited qty.)
$289

Elenco Model LCR-1810

$99.95

- Capacitance .1pF to 20μF
- Inductance 1μH to 20H
- Resistance .01Ω to 2000MΩ
- Temperature to 750°C
- DC Volts 0 - 20V
- Frequency up to 15MHz
- Diode/Audible Continuity Test
- Signal Output Function
- 3 1/2 Digit Display

Elenco Model M-1005K



$14.95

Digital Multimeter Kit

- 18 Ranges
- 3 1/2 Digit LCD
- Transistor Test
- Diode Test

M-1000B (Assembled) **$14.95**

Dual-Display LCR Meter w/ Stat Functions
B&K Model 878

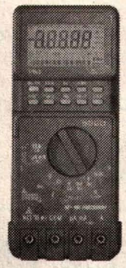
$219.95

Auto/manual range

Many features with Q factor

High Accuracy

B&K Model 5390



$295

- 50,000 Count
- 0.025% DCV
- True RMS, AC or AC+DC
- 0.07% ohms
- 100kHz AC Response
- Autoranging, Bargraph with Zoom.
- Capacitance to 50,000μF
- Frequency, Duty Cycle, Pulse Width
- dB across 1Ω to 10kΩ
- Disturbance Indicator

Oscilloscopes

Free Dust Cover and 2 Probes

S-1325	25MHz	Dual Trace	$325
S-1330	25MHz	Delayed Sweep	$439
S-1340	40MHz	Dual Trace	$475
S-1345	40MHz	Delayed Sweep	$569
S-1360	60MHz	Delayed Sweep	$749
S-1390	100MHz	Delayed Sweep	$995

DIGITAL SCOPE SUPER SPECIALS

DS-203	20MHz/10Ms/s Analog/Digital	$695
DS-303	40MHz/20Ms/s Analog/Digital	$995
DS-603	60MHz/20Ms/s Analog/Digital	$1295

TEKK Radios

Both Models Available in Yellow, Blue & Black

Pro-Sport FRS Two-Way Radio
Model PRO-SPORT+

Talk up to 2 miles!

No License Required

Model PRO-SPORT

- 1/2 Watt Output, 14 Channels.
- TX LED Indicator.
- Removable Belt Clip.
- Highly Water Resistant.
- Economy Type
- No License Required!

$68.00 each or 2 for $109.95

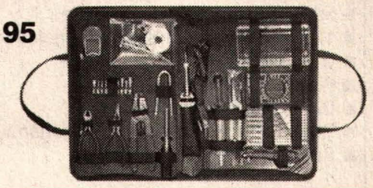
Model PRO-SPORT +

- 1/2 Watt Output, 14 Channels.
- TX & RX LED/LCD Indicators.
- Large LCD Display.
- 38 Privacy (CTCSS) Tones.
- Plus All Features of Pro-Sport Model.

$79.00 each or 2 for $149.95

Elenco Technician Tool Kit

Model TK-1500 **$49.95**



28 tools plus a DMM (M-1000B) contained in a large flexible tool case with a handle ideal for everyone on the go.

Guaranteed Lowest Prices

UPS SHIPPING: 48 STATES 5%
OTHERS CALL FOR DETAILS
IL Residents add 8.25% Sales Tax

C&S SALES, INC.

150 W. CARPENTER AVENUE
WHEELING, IL 60090
FAX: (847) 541-9904 (847) 541-0710

SEE US ON THE WEB → **www.cs-sales.com**

15 DAY MONEY BACK GUARANTEE
2 YEAR FACTORY WARRANTY

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CIRCLE 322 ON FREE INFORMATION CARD

Since 1971

You'll "Bookmark" This Site!

WWW.WEB-TRONICS.COM

Circuit Specialists Inc.

B/W Board Camera with Infra-Red

ONLY $59

Part #VMCB-21

And that's not all!

Color Board Cameras with Audio Function

ONLY $144

Part #VM3010-A

We also have great deals on bullet (B/W & color) cameras, pinhole cameras (B/W & color), some with audio. Get specs, details & prices from our web site.

Full-Sized, Full Featured DMM

ONLY $19

Part #9300G

Even includes the rubber boot

Hard Drive Slide Rack for 3.5" IDE Drives

ONLY $14.95

Part #RH-10C-IDE

Allows for easy removal of hard drives. Includes key-lock!

Electronic Soldering Station with Ceramic Heating Element, 3-Conductor Grounded Power Cord, 250-480°C (470-900°F) Fast Heating

ONLY $39

Part #SR-976

Extra tip selection on our web site.

Get all of the specifications and details on these items and thousands of other electronic components, test equipment, PCB supplies, computer parts, and much much more at www.web-tronics.com.

Secure on-line ordering, or by FAX, toll free, or snail mail.

VISA NOVUS MasterCard

Circuit Specialists, Inc.

800-528-1417/(602)464-2485

FAX (602)464-5824

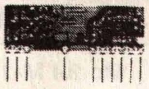
RF Data Modules

AM Transmitter

- Sub Miniature module
- SAW Controlled
- No adjustable components
- Low current - 2.5mA
- Supply 2.5-12Vdc
- 418MHz or 433MHz
- Range up to 300ft
- CMOS/TTL data input
- 7 x 11 x 4mm !

AM-TX1-xxx $12.60

AM Receiver



- Compact Hybrid Module
- Very stable
- CMOS/TTL output
- Patented Laser Trimmed
- 5Vdc, 0.8mA (HRR6)
- 2kHz data rate
- Sensitivity -105dBm
- 38 x 12 x 2 mm

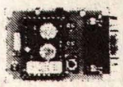
AM-HRR6-xxx.... $16.33

FM Transceiver

- Only 23 x 33 x 11mm
- Up to 40,000bps data rate
- Up to 450ft. range.
- 5V operation
- 418MHz or 433MHz FM
- 5V CMOS logic interface
- Fast 1mS enable
- Power saving feature
- Carrier Detect output

BiM-xxx-F $87.36

RS232 Transceiver



- 3wire RS232 interface
- 19.2Kbps half duplex
- 418MHz or 433MHz FM
- 7.5-15Vdc, 20mA
- TX/RX Status LED's
- Up to 400ft. range
- 1/4 wave ant. on board
- User data packetizing
- 58 x 40 x 15mm

CYPHERNET $139.30

AM Transmitter

- Range up to 250ft.
- SAW controlled stability
- Wide supply range 2-14V
- CMOS/TTL input
- Low current. 4mA typ.
- Up to 4kHz data rate
- Small: 17 x 11mm

AM-RT5-xxx $12.10

ABACOM TECHNOLOGIES

Free Catalog

tel: (416)236 3858

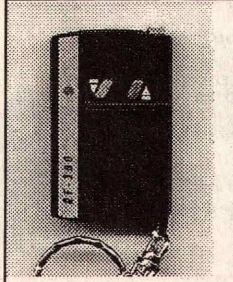
fax: (416)236 8866

www.abacom-tech.com

MasterCard / VISA

Miniature Transmitters and Receivers

2 Button / 3 Channel Transmitter



RF300T

1....$22.95

5.....$19.95 ea

10...$16.95 ea

RF300XT

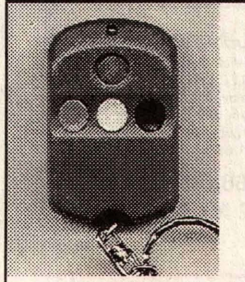
1....$25.95

5.....$22.95 ea

10...$19.95 ea

- 300' (XT), 150' (T) Range
- Frequency: 318 MHz
- 59,049 Settable Security Codes
- 12 Volt Battery and Keychain Included
- Current Draw: 4.8 ma
- Fully Assembled in Case
- Dimensions: 1.25" x 2.0" x .5"
- Push both buttons for the 3rd Channel
- Slide Button Cover Included

4 Button / 15 Channel Transmitter



RF304XT

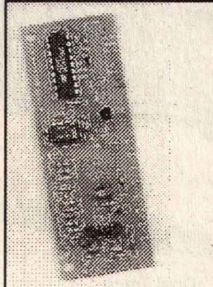
1....$27.95

5.....$24.95 ea

10...$21.95 ea

- 250' Range
- Frequency: 318 MHz
- 6,561 Settable Security Codes
- 12 Volt Battery and Keychain Included
- Current Draw: 4.6 ma
- Fully Assembled in Case
- Dimensions: 1.35" x 2.25" x .5"
- Push combination of buttons to achieve up to 15 channels

2-4 Data / 3-15 Channel Receivers



RF300RL
RF300RM

1....$27.95

5.....$24.95 ea

10...$22.95 ea

RF304RL
RF304RM

1....$29.95

5.....$26.95 ea

10...$23.95 ea

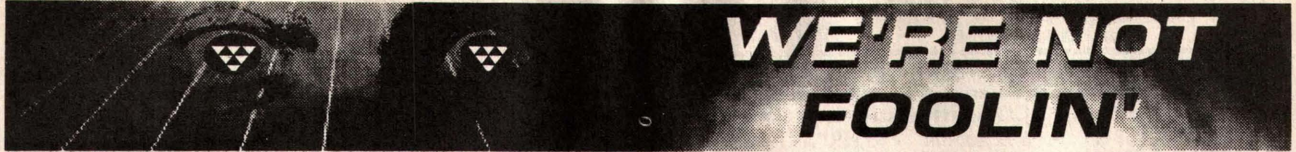
- Compatible with 300/4 Transmitters
- 11-24 volts DC Operating Voltage
- 13 ma. Current Draw
- Latching (L) or Momentary (M) Output
- Kits Available (subtract $5.00 ea.)
- Dimensions: 1.25" x 3.75" x .5"
- 2 (300) / 4 (304) Output Data Lines
- Binary to Dec / Hex Converter can achieve up to 15 channels

- Alarm Systems
- Garage / Gate Openers
- Lighting Control
- Magic Props
- Medical Alert
- Monitoring Systems
- Industrial Controls
- Surveillance Control
- Motor Control
- Schematics Available
- Receiver Board Layout Available
- Custom Design Consulting Available

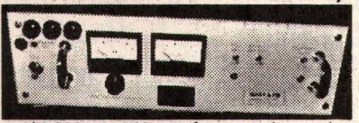
Visitect Inc. (510) 651-1425 Fax: (510) 651-8454 Email: Support@Visitect.Com

P.O. Box 14156, Fremont, CA 94539 Visa / Mastercard, COD

CIRCLE 310 ON FREE INFORMATION CARD



EXTREMELY HIGH VOLTAGE, 100KV, POWER SUPPLY,



Brand new, Wallis Model: A214-51, rack mount style. Made in the UK. We have no tech. data. If you need one of these you know what it is. Panel meters indicate 0-100KV and 0-100mA. A 10 turn front panel control sets the output voltage. We would like to get more information. Please call. **Ltd. Qty. 100KV Supply.......$995**

WORLDS SMALLEST, 100mW, VIDEO TRANSMITTER,

Only 0.98" x 0.8" x 0.037" in size. Transmits crystal controlled, hi-res., color or B&W images with 100mW output! The transmitter you've been waiting for. **Shown actual size.** Much smaller than the 9V battery which powers it. Draws only 35mA! Factory tuned. Receive on cable channel 59. UHF Bow tie antenna with balun and 3' F cable for TV supplied. Perfect with GM1000A camera. Both will fit in a cigarette pack....with the battery! The best anywhere.

TVX-100........$189 with GM1000A-PH CAM............$268

SUPER! UNDERWATER (to 60 ft.) "INSPECTION" CAMERA with INTERNAL INFRA-RED ILLUMINATOR!

Sleek black anodized, BRASS, housing is O-Ring sealed & WATERPROOF. Adjustabe mount included. Specs: 1/3" CCD, 400 Lines resolution, 0.05 Lux sensitivity, AGC, Auto Shutter. Operates on 12VDC @225mA, 3.6mm, 92⁰ FOV glass lens. NTSC video out. Superior construction. SENSITIVE to IR. Ultra small Size only: 1.25"d. X 2" long. With 60 ft. cable. Great for gen'l outdoor use also. **GM-300K...$199**

TWO MINI C-MOUNT CAMERAS, Super sensitive, GM410 or the general purpose GM412,

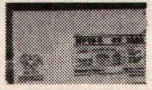
The GM-412 specs: B&W, size 1.5"sq. X 2.4"L, 250,000 Pixels, **380** Lines Resolution, Sensitivity **0.3** Lux, The GM410 specs: size only 1.5" SQ. x 1.6"L, >270,000 Pixels, **410** Lines Res., Sens. **0.05 LUX.**, Both cameras are 1/3" CCD with AGC & Electronic shutter. 12V @110mA power. NTSC out. IR SENSITIVE, BNC video out, Both use std. DC pwr. jack. Aluminum housings with dual threaded top and bottom mounting. True performance not hype! These cameras will outperform *ANY* camera in this magazine. Multi- lens options are available.

GM412, less lens..$119, GM410, less lens..$169

C-MOUNT LENS OPTIONS to ENHANCE YOUR IMAGE:
Fast Lenses for Low Light or General Purpose Normal Light

16mm, f1.6, 15° FOV $39	**4mm, 80° FOV $24**
8mm, f1.3, 40° FOV $49	**8mm, 40° FOV $24**
4mm, f1.4, 78° FOV $49	**12mm, 28° FOV $24**

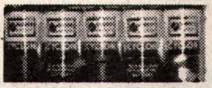
6V @ 12 AH SEALED, RECHARGEABLE, LEAD ACID BATTERY



Brand new Panasonic type LCR6V12PI, tough to get at a discount. Very compact. Use two for a 12V@ 12AH pack. Two top mounted 1/4" faston connectors. Perfect for robotics and other high drain applications. Size: 5.9"L x 3.7"H x 1.97"D

REG. $18ea. NOW 2 for $20, or 10/$89

10V @ 2.5 AH SEALED, LEAD ACID, PACK



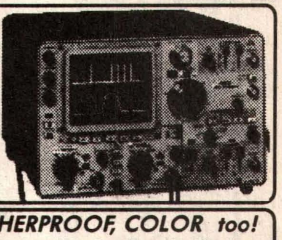
Each pack consists of five, 2 Volt cells. Each cell the size of a std. 'D' battery. Arrainged as 1X5 cells. Enclosed in an ABS outer shell. (removed for photo) Mint condition. Perfect for high drain and robotics applications. Make custom packs of any rating. Size: 7.5"L x 2.8"H x 1.5"D **5-five packs ....$20, 30 for $99**

STEREO HEADPHONES from KOSS.

Brand new type HP/1, "walkman" style, very lightweight, good quality. Adjustable metal headband with the usual padded earpieces. They sound good and the price is right. Now is the time to replace that beat up pair you've been using all summer. Standard 1/8" stereo phone plug with extra long 8 1/2 ft. cable. Black color.

Special....$3.95ea. or 5 for $15

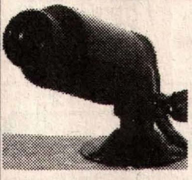
350MHz, TEK 485,



A superior performing O'scope, Dual Trace, Delayed sweep 1 nS/div Sweep rate, 5mV Vert. sensitivity. Switchable input imped., 50 ohm / 1meg. Package includes 2 probes, cover and operation manual.

ORIG., $9100ea. SPECIAL......$795

CHECK THIS! ULTRA MINI, WEATHERPROOF, COLOR too!



NEW "COLOR LIPSTICK" camera. For those applications that must be color, this is it. Black anodized, aluminum, housing is O-Ring sealed & RAINPROOF. Adjustable tilting mount included. Specs: 1/3" CCD, 400 Lines resolution, <1 Lux sensitivity, AGC, Auto Shutter. 12VDC @180mA, 4.3mm, 78⁰ FOV lens, A real glass lens. Std. video out. Size: 32mm diam. X 65mm long. 24" leads with RCA jack and DC jack. Ready to go!

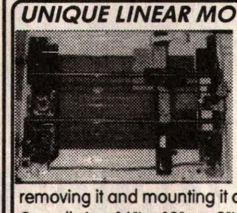
SPECIAL this MONTH, GM-400K....$249 pwr. adapter...$4.95

HIGH RESOLUTION OPTICAL ENCODERS
2500PPR, 10,000PPR in quadrature!

DRC MODEL 25-S351-B16-2500, Diff. line driver output. Size: 2.5"d, 1/4" ball bearing with shaft seal. Continous rotation., 3000 RPM max. Alum. housing, 5V powered with zero reference out, 18" cable.

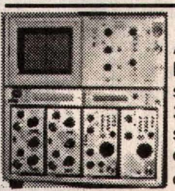
Ltd. Qty. SPECIFY NEW.....$69ea. or USED.....$49ea.

UNIQUE LINEAR MOTION BASE,



Origially intended as the motion drive for a high end, desktop, flat bed scanner. These are new units removed from a discontinued model. Movement is via a stepper motor & toothed belt drive, moving the carriage 12" accross two polished stainless steel rails. (the action that moves the lamp across the page.) The assembly is mounted to the scanner cover. We recommend removing it and mounting it on your base. Incl. optical end of travel detector. Overall size: 16"L x 13"w x 2"H. Nicely made. **LMB-2...$29ea. or 2 for $49**

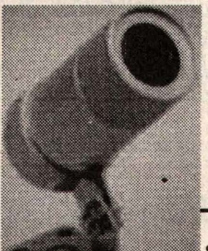
TEK 7104, 1GHz O'SCOPE with MICRO CHANNEL PLATE CRT



Their highest bandwidth & highest writing speed model. Unsurpassed single shot capability, 1000x brighter than conventional CRT. 350ps risetime! 200 ps per division fastest calibrated sweep rate. Incl. two 7A29 1Ghz vertical amps, one 7B10 & one 7B15 horizontal amp. Complete operating manual, 90 day warranty. 1991 price$45K **SPECIAL.........$2495**

Please fax us your list of unique surplus material.

SPECIAL! ULTRA MINI and WEATHERPROOF !



Our "LIPSTICK" camera sets new standards. Sleek black anodized, aluminum, housing is O-Ring sealed & RAINPROOF. Adjustable tilting mount included. Specs: 1/3" CCD, 380 Lines resolution, 0.3 Lux sensitivity, AGC, Auto Shutter. Operates on 9 to 12VDC @100mA, 3.7mm, 90⁰ FOV lens, A real glass lens. NTSC video out. 1/2 once! SENSITIVE to IR. Ultra small Size only: 23mm diam. X 50mm long. With 36" leads. **GM-200KSTD..$99, AC pwr...$4.95**

PINHOLE LENS, "BULLET CAM"

So tiny you can install it right into a door with merely an 0.9" diameter hole. Sleek black anodized, extruded aluminum housing. Similar construction as the lipstick camera above only smaller! 1/3" CCD, 410 Lines Res., 0.3 Lux sens., AGC, Auto Shutter. Power from 9 to 16VDC @100mA, 250k PIXELS, 90⁰ FOV Pinhole lens. Std. NTSC video out. 1/2 once! SENSITIVE to IR. Size only 23mm Diam. x 35mm long. With 36" leads. **GM-200KPH...$99**

RESOURCES UNLTD.

300 BEDFORD STREET, MANCHESTER, NH 03101

VISA, MC, AMEX, DISCOVER, COD. ORDER: 800-810-4070 TECH. 603-668-2499 ORDER FAX: 603-644-7825 E-MAIL unltd4u@tiac.net

CIRCLE 283 ON FREE INFORMATION CARD

2539 W. 237th Street, Bldg. F, Torrance, CA 90505
Order desk only: **USA: (800) 872-8878 CA: (800) 223-9977**
L.A. & Technical Info: **(310) 784-5488** Fax: **(310) 784-7590**
OEM INQUIRIES WELCOME

TIMELINE INC.

Over 13 years and 31,000 customers and still growing

Minimum Order: $20.00. Minimum shipping and handling charge $5.00. We accept cashiers checks, MC or VISA. No personal checks or COD's. CA residents add 8.25% sales tax. We are not responsible for typographical errors. All merchandise subject to prior sale. Phone orders welcome. Foreign orders require special handling. Prices subject to change without notice. 20% restocking fee for returned orders.

LIQUID CRYSTAL DISPLAYS

240x64 dot LCD with built-in controller.

AND 4021ST-EO. *Unit is EL back-lit.* **$59.⁰⁰ or 2 for $109.⁰⁰** *or*
OPTREX. DMF5005 *(non back-lit)* **$49.⁰⁰ or 2 for $89.⁰⁰**
20 character x 8 line 7⅛L x 2½H *The built-in controller allows you to do text and graphics.*

Alphanumeric—parallel interface

16x1	$7.00	20x2	$10.00	32x2	$8.00
16x1 (lg. char.)	$10.00	20x4	$15.00	40x1	$8.00
16x2	$7.00	20x4 (lg. char.)	$10.00	40x2	2 for $20.00
16x2 (lg. char.)	$10.00	24x2	$10.00	40x4	$20.00
16x4	$15.00	32x4	$10.00	4x2	$5.00

5V power required • Built-in C-MOS LCD driver & controller • Easy "microprocessor" interface • 98 ASCII character generator • ***Certain models are backlit, call for more info.***

Graphics and alphanumeric—serial interface

size	Mfr.	price	size	Mfr.	price
640x480 (backlit)	Epson	$25.00	480x128	Hitachi	$10.00
640x400 (backlit)	Panasonic	$20.00	256x128	Epson	$20.00
640x200	Toshiba	$15.00	240x128 (backlit)	Optrex	$20.00
480x128 (backlit)	ALPS	$10.00	240x64	Epson	$15.00
			160x128	Optrex	$15.00

6" VGA LCD 640X480, Sanyo LMDK55-22 **$25⁰⁰**

MONITORS

Non-Enclosed TTL

Comes with pinout. 12V at 1.4 Amp input • Horizontal frequency 15Khz. • Ability to do 40 and 80 column.

5 inch Amber $25.00 • 7 inch Amber $25.00
9 inch Amber or Green $25.00

5" COLOR MONITOR $39.⁰⁰

- Flat Faceplate • 320 x 200 Dot Resolution • CGA & Hercules Compatible
- 12 VDC Operation • 15.75 KHz Horiz. Freq. • 60 Hz Vert. Sync. Freq.
- Open Frame Construction • Standard Interface Connector • Degaussing Coil included • *Mfr. Samtron*

9" COLOR SVGA MONITOR $179.⁰⁰ Fully Enclosed – Tilt and swivel type.

POS & BAR CODE

MAGNETIC CARD READER $25.⁰⁰

Includes: • 20 character dot matrix display with full alpha-numeric capability • keypanel with full alpha-numeric entry • separate 7.5 VDC/0.5 Amp power supply • standard telephone interface extension cord • lithium battery and flat-cone speaker.

HP bar code wand (HBCS 2300) $19.00

HACKER CORNER

EMBEDDED 486 COMPUTER $99.⁰⁰

Complete enhanced Intel 486SX-33 based computer in ultra small (9-7/8L x 6-5/8W x 3-1/8H) case. Ideal for embedded operations or as a second computer. Features include: • One 16 bit ISA slot • 3 serial ports plus dedicated printer port • Parallel optical coupled adapter port • Built in IBM PC/AT keyboard port • On board VGA video and port • Uses standard SIMM up to 32 MB • BIOS is PC/AT compatible

Unit has a backup Ni-Cd battery system in case of power failure (5 min. backup time) and lockable front cover to prevent floppy drive access. Mounting / interface provisions for standard 3.5" laptop floppy and 2.5 inch hard drives. Comes with very comprehensive manual.

SONY Miniature Color LCD Display (LCX005BKB) $29⁰⁰

• 1.4 CM (0.55 inch) Diagonal Full Color Display • Built In Horizontal and Vertical Drivers • Delta Dot Pattern for High Picture Quality - 537 dots (H) x 222 dots (V) • Compatible with NTSC & PAL Format and Sync Inputs • 12 VDC Operation with -1 to +17 V RGB Signal and Driver Input Voltage • Excellent Display for Virtual Reality Projects, Viewfinders, and Miniature Test Equipment Displays • Pin Outs and Specification Included • Unit Requires Clock, Synchronization and Video

CELL SITE TRANSCEIVER $49⁰⁰ 2 for $89⁰⁰

These transceivers were designed for operation in an AMPS (Advanced Mobile Phone Service) cell site. The 20 MHz bandwidth of the transceiver allows it to operate on all 666 channels allocated. The transmit channels are 870.030-889.980 MHz with the receive channels 45 HMz below those frequencies. A digital synthesizer is utilized to generate the selected frequency. Each unit contains two independent receivers to demodulate voice and data with a Receive Signal Strength Indicator (RSSI) circuit to select the one with the best signal strength. The transmitter provides a 1.5 watt modulated signal to drive an external power amplifier. channel selection is accomplished with a 10 bit binary input via a connector on the back panel. Other interface requirements for operation are 26 VDC (unregulated) and an 18.990 MHz reference frequency for the digital synthesizer. The units contain independent boards for receivers, exciter, synthesizer, tunable front end, and interface assembly (which includes power supplies and voltage-controlled oscillator). Service manual, schematics and circuit descriptions included.

Encased Spread Spectrum RF Modem $99⁰⁰

The ProxLink Radio Module is a small communication device which replaces cables between RS-232 devices with wireless RF (Radio Frequency) technology. Attaching a pair of ProxLinks to any two devices with three wire asynchronous RS-232 ports allows wireless data transmittal at rates up to 19.2 Kbaud (full duplex) over a range of 500 - 800 feet. Modules use 900 MZ spread spectrum radio for communication which does not require an FCC site license. A variety of configuration information (radio channel, baud rate, serial port configuration, etc.) can be programmed into module's non-volatile memory by host PC to provide compatibility and avoid overlapping systems. Configuration changes are supported by menu driven, on-board software. Commonly used Terminal Emulation software and transfer protocols can be used for configuring modules and transferring data between computers. ProxLinks require only 6-9 VDC (350 mA), RS-232 (9 pin sub - D) interface, and small (~ 4") whip antenna for operation. Unit size is 4.0" x 6.5" x 0.75". Installation schematics and application details available. These are 100 Mw power.

COLOR CCD CAMERA $89⁰⁰

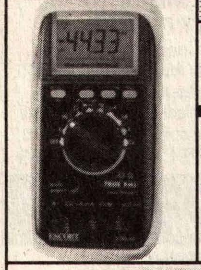
Small fully enclosed color CCD camera ideally suited for video conference and mobile operations. No separate power supply or batteries needed - single 5 VDC power requirement can be obtained from PC keyboard interface or directly from the computer using the included adapter plugs. Standard NTSC composite output from 1/4" color CCD sensor with 250,000 pixels and automatic white balance.

CIRCLE 275 ON FREE INFORMATION CARD

ALFA ELECTRONICS

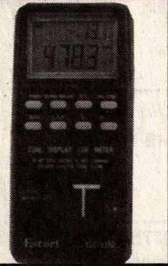
HIGH QUALITY TEST EQUIPMENT

Visit www.alfaelectronics.com for complete info
Call 1-800-526-2532 for Order and Free Catalog



DMM

DMM-89S ($179.00): true rms, AC/DC (V,A), Ω, bar graph, freq, capac., dBm, logic, diode
DMM-23T ($99.95): 4½ digit, true rms, high resol. (10μV, 10nA, 10mΩ), hFE, diode, contin.
DMM-20 ($74.95): AC/DC (V, A), Freq, cont., Capac, Induct., Ω, hFE, diode, duty cycle
DMM-122 ($59.95): DC/AC(V,A), Ω, hFE, diode, capacitance, freq, logic, continuity
DMM-123 ($44.95): DMM + capacitance, DC/AC(V,A), Ω, hFE, diode, continuity
DMM-10 ($19.95): 3½ digit, DC/AC V, Ω, hFE, diode, signal output(+3V,-0.5Vsq.,50%duty)



LCR /COUNTER

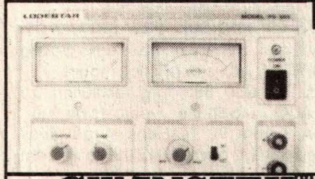
CAP-15 *($49.95)*: 3½ digit, 0.1pF-20mF, 9 Ranges, 0.1pF resolution, zero adjustment.
LCR-24 *($119.95)*: 0.1μH-200H, 0.1pF-2000μF, 0.01Ω-20MΩ, diode test. *New Model.*
LCR-131D *($219.95)*: autorange, 0.1μH-10kH, 0.1pF-10mF, 1mΩ-10MΩ, Q Factor, serial/parallel, 120Hz/1kHz testing mode.
FC-1200 *($129.95)*: 1.25GHz Handheld, 8 digits display, 10ppm accurary, sensitivity 5mV (130-350MHz), 30mV (440MHz)

FLUKE

12B	$ 94.95
70-III	$ 99.00
73-III	$125.00
75-III	$155.00
77-III	$173.00
79-III	$195.00
87-III	$325.00
92B-III	$1,445
96B-II	$1,695
99B-III	$2,095
105B	$2,495
123-III	$1,130
863E	$555
867B	$740

SPECIALTY

• AC Current Probe	$34.95
• DC/AC Current Probe	$79.95
• Mini AC Clamp	$59.95
• AC Clamp w/temp	$89.95
• DC/AC Clamp	$109.95
• Thermometer	$69.95-$89.95
• IR Thermometer	$189.95
• Sound Level Meter	$169.95
• Tachometer	$169.95-$219.95
• EMF Tester	$69.95
• Pressure Meter	$299.95
• Watt Meter	$129.95
• High Voltgae Probe	$59.95
• pH Meter	$79.95
• Light Meter	$79.95-$89.95



Single Output DC Power Supplies

- Constant current, constant voltage mode
- Short Circuit and overload protected

Analog Meters Display	***Digital Volt, Analog Current***
PS-303 ($159.00) 30V/3A	PS-8200 ($179.95) 30V/3A
PS-305 ($219.95) 30V/5A	PS-8201 ($239.95) 30V/5A
PS-8112 ($399.95) 60V/5A	***Digital Volt & Current Display***
PS-1610 ($289.00) 16V/10A	PS-8300 ($199.95) 30V/3A
PS-8107 ($399.95) 30V/10A	PS-8301 ($259.95) 30V/5A

Triple Output

- Independence or Tracking operation
- Parallel to double current output (PS-8102 & PS-8103 only)

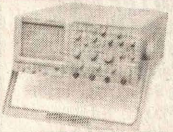
Triple Output (Analog displays)
PS-8102 ($399.95) 30V/3A/30V/3A
PS-8103 ($489.95) 30V/5A/30V/5A
Digital Displays
PS-8202 ($499.95) 30V/3A/30V/3A
PS-8203 ($549.95) 30V/5A/30V/5A

AUDIO/RF/FUNCT. GEN.

RF Generator • SG-4160 ($124.95) 100kHz-150MHz sinewaves in 8 ranges
• **SG-4162AD**($229.95) with 6 digit counter
Audio Generator • AG-2601 ($124.95) 10Hz-1MHz, 0-8Vpp sine, 0-10Vpp squarewave
• **AG-2603AD** ($229.95) with 6 digit counter
Function Generator • FG-2100A ($154.95) 0.2Hz-2MHz,5mV-20V_{PP}
• **FG-2103** ($329.95) *Sweep* 0.5Hz-5MHz

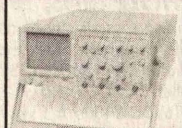
GW/INSTEK®

20 MHz Scope



• OS-620 $324.95
- Most economical scope
- Dual CH/X-Y operation
- 1 mV/div sensitivity
- Z-axis input,CH1 output
- TV syn, ALT trigger
- 2 probes (x1, x10)

Cursor Readout



• OS-626G $599.95
- **Readout & Cursor meas**
- Dual CH / Delay sweep
- Built-in delay line
- ALT trigger, Hold-Off
- Z-axis input,CH1 output
- 2 probes (x1, x10)

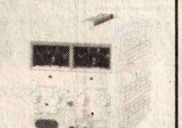
DC POWER SUPPLIES

Triple Output

- 2 variable out 0-30V,0-3A
- One fixed 5V,3A output
- Auto track, serial, parallel
- Const. volt, current mode
- 4 analog or 2 digital display

PC-3030 ($499.95)
PC-3030D ($549.95) digital

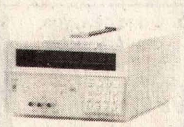
Single Output



- Const voltage, current mod
- Voltage regulation ≤0.01%
- Current regulation ≤0.2%

PS-1830 ($198.95) 18V/3A
PS-1850 ($214.95) 18V/5A
PS-1830D($214.95)18V/3A
PS-1850D($244.95)18V/5A

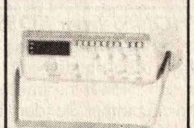
Programmable



- Auto serial/parall.(PPT ser)
- Auto track (PPT series), IEEE-488.2 and SCPI compatible command set

PPS-1860G($1,149.95)18V/6A
PPS-3635G($1,149.95)36V/3.5A
PPT-1830G($1,499.95)18V/3A
PPT-3615G($1,499.95)36V1.5A

FUNCTION GENERATOR

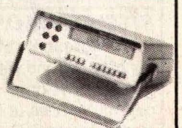


FG-8020G ($209.95)
- 0.02Hz-2MHz w/counter
- Sine/Squ/Tri/pulse/Ramp

FG-8020G ($209.95)
- 0.02Hz-2MHz w/counter

FG-8050 ($449.95) Sweep
- 0.05Hz-5MHz w/counter
- INT/EXT AM/FM mod

BENCHTOP DMM



DM-8034($179.95) 3½ dgt
- AC/DV(V,A),C,Ω,diode

DM-8040($339.95) 3¾ dgt
- ACV to 50kHz, true rms

DM-8055G($889.95)5½dgt
- 0.006% accuracy, GPIB
- dBm,auto,REL, min/max

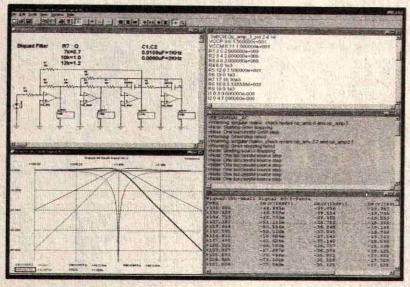
ALFA ELECTRONICS
P.O. BOX 8089
PRINCETON. NJ 08543-8089

TEL: (800)526-2532 / (609) 897-1135
FAX: 609-897-0206
E-mail: sales@alfaelectronics.com

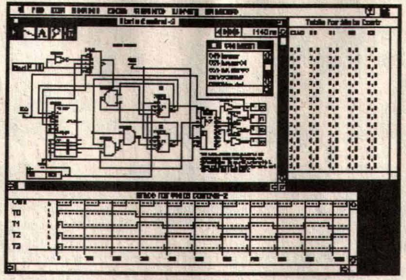
Call / Write / Fax / Email for FREE CATALOG
Visa, MC, AMEX, COD, PO Accepted. OEM Welcome.
1 Year Warranty (2 Years for GW/Instek)

CIRCLE 213 ON FREE INFORMATION CARD

CIRCUIT DESIGN FOR WINDOWS AND MACINTOSH



B^2 SPICE



B^2 LOGIC

B^2 SPICE and B^2 LOGIC are the best values in circuit simulation tools. They are used at over 100 major universities and many leading Fortune 500 companies including the University of Michigan, Stanford, AT&T, General Electric, and Motorola.

B2 Logic provides precise and customizable timing of individual pins on each device. No other program in this price range will help you catch as many timing glitches and violations. It also supports busses and subcircuits to facilitate the design of complex circuits.

B2 Spice integrates an intuitive interface with an optimized Spice engine. With a library of over 3000 parts, you will be able to find the part you need. In case you don't find it, you can easily import new parts into the libraries. The interface supports the full set of Spice3F5 simulations as well as Temperature and Parameter sweeps.

B^2 SPICE $249

- Simulations: DC, Parameter, Dual,and Frequency Sweeps, Transient, Noise, Fourier, Transfer Functions, Pole-Zero, Distortion
- Spice 3F5 (32-bit)
- Over 3000 devices
- Over 30 parameterized devices
- Powerful graph interface
- Device and model parameter dialogs
- Run simulations directly from netlists

B^2 LOGIC $179

- Subcircuits and subcircuit probing
- Precise customizable pin timing
- Over 100 components available
- Define new devices with equations and tables including state variables

ELECTRONIC DESIGN PACKAGE $279

- Includes B^2 SPICE and B^2 LOGIC

- Demo Disks Available
- University & Student Prices Available
- Site Licenses Available
- Dealer Inquiries Welcome
- Visa/MasterCard Accepted

Beige Bag Software
279 E. Liberty
Ann Arbor • Michigan • 48104

Phone 734.332.0487
Fax 734.332.0392
E-Mail info@beigebag.com
Internet www.beigebag.com

CIRCLE 204 ON FREE INFORMATION CARD

Network Service Tool Set

Popular installation and service tools for networks, modems and telephones. All hand tools are professional heavy duty type.

Use the compact tester on 10BASE-T (UTP & STP), thin Ethernet (BNC), 8-position Token Ring, AT&T 258A and EIA/TIA 568A/B. Automatically scans cables for continuity, wiring sequence and polarization. Tests STP cable ground. Testing installed cables is easy with Remote Terminator · and gender changers (UTP and BNC). 9V battery included.

- Coax Stripping Tool, RG-58 & RG-59
- BNC Crimping Tool, RG-58 & RG-59
- Modular Cutting/Stripping/Crimping Tool (4, 6 & 8-Position)
- Multi-Network Cable Tester
- AC Receptacle Tester
- Cable Cutter

Order No. 55625 $197.00

PC Diagnostic Tool Set

- AMI Diagnostic Software
- POST Card

Order No. 55555 $89.00

Network Installation Tool Set

- Network Tool Set 55625 without the Multi-Network Cable Tester.

Order No. 55600 $99.00

Call for your FREE Catalog

Graymark®

P.O. Box 2015 Tustin, CA 92781
http ://www.labvolt.com

PC Service Tool Set

Contains all tools needed to troubleshoot & service IBM-compatible PCs. Set includes:

- AMI Diagnostic Software
- POST Card
- Logic Probe
- Digital Multi-Meter
- AC Receptacle Tester
- Serial Adapter
- Serial & Parallel Loopback Connectors
- DIP IC Puller
- PLCC IC Puller
- Grounding Wrist Strap
- Key Top Puller

Order No. 55000 $198.00

CALL TODAY!

800-854-7393

VISA MasterCard AMERICAN EXPRESS Cards DISCOVER NOVUS

CIRCLE 329 ON FREE INFORMATION CARD

Robotics for the Next Millennium.

Exploring the New World of Science Kits.

OWI's "Next Generation" of affordable, rugged Robot Kits for the next millennium challenges the enthusiast to solder circuit boards and / or mechanically assemble.

Each OWIKIT also incorporates the basic principles of robotic experiments, sensing and locomotion, guaranteeing an exciting, hands-on adventure of knowledge and fun!

But remember! OWI is the recognized founder and leader in Educational Robot Kits. ***ACCEPT NO IMITATIONS.***

Visit our homepage at www.owirobot.com

WAO-G	OWI-968K	Fuzzy Logic	68 Pg. Book	89.95
ROBOTIC ARM TRAINER	OWI-007	5 Axis Control	53 Pg. Book	69.95
TRIPLE ACTION SOLAR CAR	OWI-685	Solar Sensor	27 Pg. Book	39.95
S-CARGO	OWI-936K	Sound Sensor	47 Pg. Book	36.95
WAO II	OWI-961K	Programmable - Graphic	59 Pg. Book	69.95
SPIDER	OWI-962K	Infrared Sensor	49 Pg. Book	49.95
LINE TRACKER	OWI-963K	Infrared Sensor	48 Pg. Book	49.95
HYPER PEPPY	OWI-969K	Sound / Touch Sensor	46 Pg. Book	24.95
MOON WALKER	OWI-989K	Solar Sensor	10 Pg. Book	34.95

Be on the lookout for the new exciting
- ***Amphibious Solar Vehicle***
- ***Remote Controlled Cyclone***
- ***Infrared Sumo Robot***

NEW
WAO-G
Fuzzy Logic Robot – *Draw straight lines, circles and words; learn fuzzy control principles.*

EK
ELEKIT

17141 Kingsview Ave., Carson, CA 90749
Phone: (310) 515-6800
Fax: (310) 515-1606
Toll Free: (877) 4-ELEKIT (353548)
E-mail: owi@ix.netcom.com
Web Page: www.owirobot.com

MasterCard VISA

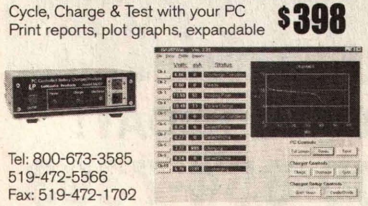
Order M – F: 8a.m. – 4p.m. PST

CIRCLE 334 ON FREE INFORMATION CARD

Battery Analyzer

- —⊣|⊢|⊢|⊢— +

PC-Controlled Battery Analyzer
Cycle, Charge & Test with your PC
Print reports, plot graphs, expandable
$398



Tel: 800-673-3585
519-472-5566
Fax: 519-472-1702

LaMantia Products Ltd.

Download Demo:
http://home.rogerswave.ca/lamantia
lamantia@compuserve.com

CABLE TV BOXES

(WE'LL BEAT ANY PRICE!)
30 DAY TRIAL* 1YR. WRNTY. *FREE CATALOG
QTY. DISCOUNTS * DEALERS WELCOME!

1-800-538-2225

HABLAMOS ESPANOL

VISA C.O.D

http://www.tvcableboxes.com
GLOBAL ELECTRONICS INC.

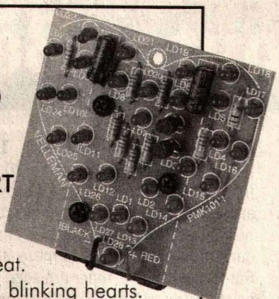
PicC C Compiler $59
for Microchip's PIC microcontrollers
Supports **PIC16C55x, 16C6x, 16C62x, 16C8x, 16C92x** PIC families

SnXC C Compiler $59
Supports **SceniX sx18ac** and **sx28ac** microcontrollers
Both compilers based on **ANSI C** standard. Arrays, unions, structures, pointers, strings, function calls, if, for, switch, while, interrupt vectors, in-line assembler code, 8 & 16 bit variables, etc. Outputs Intel Hex format and assembly code. Code optimizer included. Excellent development tools!

DebugIDE Debugger $79
C source level debugger for PicC and SnXC compilers. Integrated Development Environment. Step, Run, Stop, Reset. Variable monitoring and modification. Oscillator/cable kit ($39)
732-873-1519 fax: **732-873-1582** e: **grichrc@aol.com**
Grich RC Inc.120 Cedar Grove Ln, Ste 340, Somerset NJ USA 08873
URL: http://members.aol.com/piccompile

47pc•kit

$12.95



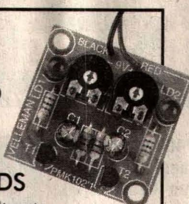
MK101

SWEETHEART

Give him or her that special heartbeat.
28 leds form 2 blinking hearts.
Power supply : 9V battery

14pc•kit

$5.95



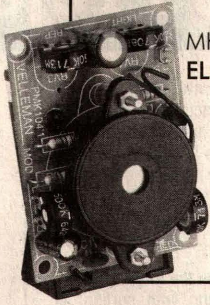
MK102

FLASHING LEDS

For different applications (such as model construction) and educational purposes.
Adjustable flashing speed.
Power supply : 9V battery

30pc•kit

$14.95



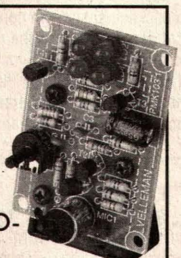
MK104

ELECTRONIC CRICKET

This cricket turns on when it gets dark.
Great as practical joke.
The tone and repetition between two crickets is adjustable.
Power supply : 9V battery

34pc•kit

$9.95



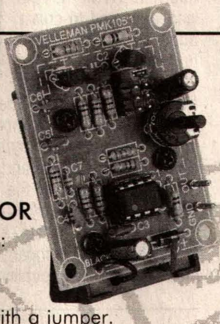
MK103

LED SOUND-TO-LIGHT UNIT

For different funny and practical applications. 4 high-intensity leds light up and react simultaneously on every sound.
Power supply : 9V battery

36pc•kit

$10.95



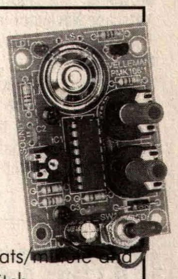
MK105

SIGNAL GENERATOR

Several signal outputs : square wave, triangle, sine and integrator which are selectable with a jumper.
The signal frequency is about 1KHz (fixed)
Ideal to learn electronics!
Power supply : 9V battery

26pc•kit

$14.95



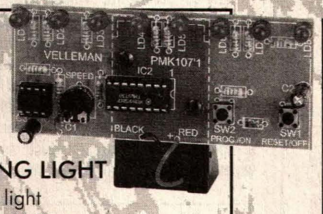
MK106

METRONOME

The beats per minute are given by a built-in speaker and by a led.
Adjustable volume, beats/minute and sound. With on/off switch.
Power supply : 9V battery

36pc•kit

$12.95



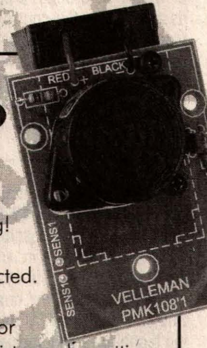
MK107

LED RUNNING LIGHT

8 leds running light
Different running effects are selectable (by prog push button)
Adjustable effect speed.
Power supply stand-by by push button.
Power supply : 9V battery

8pc•kit

$7.95



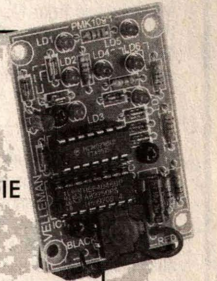
MK108

WATER ALARM

Never let you surprise by flooding!
Gives alarm sound when water is detected.
Incorporated alarm buzzer. Water sensor can be placed at distance by cutting the board and using wires to connect the sensor. Power supply : 9V battery

35pc•kit

$9.95



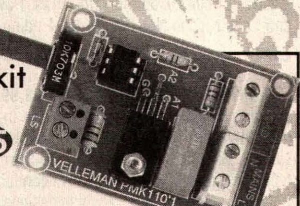
MK109

ELECTRONIC DIE

No more cheating allowed ! The eyes of the die are leds
Rolls out when the push button is released.
Power supply : 9V battery

17pc•kit

$12.95



MK110

SIMPLE ONE CHANNEL LIGHT ORGAN

With loudspeaker input. The lamp flashes on the beat of the music. Optical isolated loudspeaker input with adjustable sensitivity : 2W to 60W.
Maximum load : 120W at 120Vac.

17pc•kit

$19.95

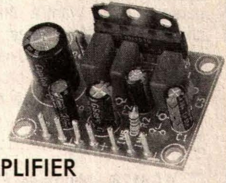
K5300

STROBOSCOPE

Adjustable flash frequency : 5-15Hz
Power supply : 120Vac
Power consumption : 13W max.

21pc•kit

$12.49



K2637

SUPERMINI 2.5W AUDIO POWER AMPLIFIER

Superb audio amplifier with incredible tiny dimensions.
Integrated circuit has a pre- and power amplifier which can be used separately.
Max. output power : 2.5W @ 4ohm
Frequency characteristics : 60Hz to 15KHz
Power supply : 4.5V to 15Vdc / 400mA

Exists also as module : M2637 **$17.49**

velleman

7415 Whitehall Street Suite 119
Fort Worth, TX 76118
(817) 284-7785 F : (817) 284-7712
www.velleman.be email : velleman@earthlink.net

Questions ? Contact us for a list of US distributors or to get your *FREE* catalogue

CIRCLE 282 ON FREE INFORMATION CARD

Budget Project and Computer Books

☐ **BP317–Practical Electronic Timing $6.99.** Time measurement projects are among the most constructed gadgets by hobbyists. This book provides the theory and backs it with a wide range of practical construction projects. Each project has how-it-works theory and how to check it for correct operation.

☐ **BP415–Using Netscape on the Internet $8.99.** Get with the Internet and with surfing, or browsing, the World Wide Web, and with the Netscape Navigator in particular. The book explains: The Internet and how the World Wide Web fits into the general scenario; how do you go about getting an Internet connection of your own; how to download and install the various versions of Netscape browsing software that are available; and how to use Netscape Navigator to surf the Web, and to find and maintain lists of usful sites. There's a heck of a lot more, too!

☐ **BP325–A Concise User's Guide to Windows 3.1 $6.99.** Now you can manage Microsoft's Windows with confidence. Understand what hardware specification you need to run Windows 3.1 successfully, and how to install, customize, fine-tune and optimize your system. Then you'll get into understanding the Program Manager, File Manager and Print Manager. Next follows tips on the word processor, plus how to use Paintbrush. There's more on the Cardfile database with its auto-dial feature, Windows Calendar, Terminal, Notepad, etc.

☐ **BP327–DOS: One Step at a Time $5.99.** Although you spend most of your time working with a word processor, spreadsheet or database, and are probably quite happy using its file management facilities, there will be times when you absolutely need to use DOS to carry out 'housekeeping' functions. The book starts with an overview of DOS, and later chapters cover the commands for handling disks, directories and files.

☐ **PCP119–Electronic Music and Midi Projects $12.95.** Save cash by building the MIDI gadgets you need. Want a MIDI THRU box, program change pedal, Metronome, analog echo unit, MIDI patchbay or switcher? Over 16 practical and very useful music and MIDI projects—all in this book! The projects are explained in detail with full instructions on assembly.

☐ **PCP120—Multimedia on the PC! $14.95.** What is Multimedia? What can it do for you? It can do lots of nice things! This 184-page book helps you create your own multimedia presentation. Multimedia applications by people like you can revolutionize educational and business applications as well bring more fun, fun, fun into your leisure computer activities.

☐ **BP404–How To Create Pages for the Web Using HTML $7.99.** Companies around the world, as well as PC users, are fast becoming aware of the World Wide Web as a means of publishing information over the Internet. HTML is the language used to create documents for Web browsers such as Mosaic, Net-scape and the Internet Explorer. These programs recognize this language as the method used to format the text, insert images, create hypertext and fill-in forms. HTML is easy to learn and use. This book explains the main features of the language and suggests some principles of style and design. Within a few hours, you can create a personal Home Page, research paper, company profile, questionnaire, etc., for world-wide publication on the Web.

☐ **BP377—Practical Electronic Control Projects $7.99.** Electronic control theory is presented in simple, non-mathematical terms and is illustrated by many practical projects suitable for the student or hobbyist to build. Discover how to use sensors as an input to the control system, and how to provide output to lamps, heaters, solenoids, relays and motors. Also the text reveals how to use control circuits to link input to output including signal processing, control loops, and feedback. Computer-based control is explained by practical examples.

☐ **BP411—A Practical Introduction to Surface Mount Devices $6.99.** This book takes you from the simplest possible starting point to a high level of competence in working with Surface Mount Devices (SMD's). Surface mount hobby-type construction is ideal for constructing small projects. Subjects such as PCB design, chip control, soldering techniques and specialist tools for SMD are fully explained. Some useful constructional projects are included.

☐ **BP136—25 Simple Indoor and Window Aerials $2.99.** Many people live in flats and apartments where outdoor antennas are prohibited. This does not mean you have to forgo shortwave listening, for even a 20-foot length of wire stretched out under a rug in a room can produce acceptable results. However, with experimentation and some tips, you may well be able to improve further your radio's reception. Included are 25 indoor and window antennas that are proven performers. Much information is also given on shortwave bands, antenna directivity, time zones, dimensions, etc. A must book for all amateur radio enthusiasts.

☐ **BP379—30 Simple IC Terminal Block Projects $6.99.** Here are 30 easy-to-build IC projects almost anyone can build. Requiring an IC and a few additional components, the book's 'black-box' building technique enables and encourages the constructor to progress to more advanced projects. Some of which are: timer projects, op-amp projects, counter projects, NAND-gate projects, and more.

☐ **BP401—Transistor Data Tables $7.99.** The tables in this book contain information about the package shape, pin connections and basic electrical data for each of the many thousands of transistors listed. The data includes maximum reverse voltage, forward current and power dissipation, current gain and forward transadmittance and resistance, cut-off frequency and details of applications.

☐ **ETT1—Wireless & Electrical Cyclopedia $4.99.** Step back to the 1920's with this reprinted catalog from the Electro Importing Company. Antiquity displayed on every page with items priced as low as 3 cents. Product descriptions include: Radio components, kits, motors and dynamos, Leyden jars, hot-wire meters, carbon mikes and more. The perfect gift for a radio antique collector.

☐ **BP93–Electronic Timer Projects $2.99.** This book covers many of the possible applications of timer circuits. These circuits may turn on or off at either some preset time or after an elapsed time. Some of the more complicated timer and clock circuits are made up from a number of simpler circuits that the author deals with individually. Also included are several special interest circuits such as cars windshield wiper delay unit, a darkroom timer, metronome, etc.

☐ **BP88–How To Use Op-Amps $5.99.** Written as a designer's guide covering many operational amplifiers, serving both as a source book of circuits and a reference book for design calculations. There are chapters on Meet the Operational Amplifier, Basic Circuits, Oscillators, Audio Circuits, Filters, Miscellaneous Circuits, Common Op Amps, Power Supplies and Construction Notes and Fault Finding.

☐ **BP76–Power Supply Projects $3.99.** Presents a number of power-supply designs including simpled unbiased types, fixed voltage-regulated types and variable voltage stabilized designs. All are low-voltage types intended for use with semiconductor circuits. Apart from presenting a variety of designs that will satisfy most applications, the data in this book should help the reader to design his own power supplies. An essential addition to the experimenters electronics library.

ELECTRONIC TECHNOLOGY TODAY INC.
P.O. BOX 240, Massapequa, NY 11762-0240

Name ______________________________

Address ____________________________

City____________State ________Zip________

NW2 **Allow 6-8 weeks for delivery**

SHIPPING CHARGES IN USA AND CANADA

$0.01 to $5.00	$2.00
$5.01 to $10.00	$3.00
$10.01 to $20.00	$4.00
$20.01 to $30.00	$5.00
$30.01 to $40.00	$6.00
$40.01 to $50.00	$7.00
$50.01 and above	$8.50

SORRY No orders accepted outside of USA & Canada

No. of Books Ordered ☐

Total price of books .... $__________
Shipping (see chart) .... $__________
Subtotal .... $__________
Sales Tax (NYS only) .... $__________
Amount Enclosed .... $__________

All payments must be in U.S. funds!

MONDO·TRONICS'

ROBOT STORE

*** KITS ***

Your

*** BOOKS ***

Mailorder

*** PARTS ***

Source

*** VIDEOS ***

For

*** MODELS ***

Robots!

*** MORE! ***

(REQUEST OUR FREE CATALOG)

www.robotstore.com

800-374-5764

Or write to us:
4286 Redwood Hwy #226-137
San Rafael CA 94903
Phone 415-491-4600 • Fax 415-491-4696
Email info@mondo.com

SUPERCIRCUITS

America's #1 Microvideo Source

MICRO VIDEO TOP 10

1. World's Smallest Video Camera* ..... 1 lux, .3oz. $59.95
2. Pinhole Video Camera .. 410 lines, 0.5 lux, Sharp chip $39.95
3. Color Video Camera .... 350 lines, 2 lux, Remote head $69.95
4. Tiny Super Pinhole Cam* .... Less than 1" square $99.95
5. IR Video Camera ... Hi-res, light is invisible to humans $209.95
6. Lipstick Pinhole Camera .. 410 lines, 0.5 lux, Bracket $99.95
7. Micro Video Transmitter ..... 1000' rnage, ATV band $149.95
8. World's Smallest Color Video Cam . Hires CMOS $199.95
9. World's Smallest Wireless Video Cam .... Please Call
10. Video Goggles .... Dual hi-res LCD's, 3D capable $599.95

If you're looking for the best in microvideo...
Call us today and get our new catalog!

1-800-335-9777 ext ES

Or fax us at 512-260-0444

www.supercircuits.com

Listed In Guinness Book of Records*

*Supercircuits PC-21XP and PC-51XS are listed as world's smallest pinhole and spy video cameras

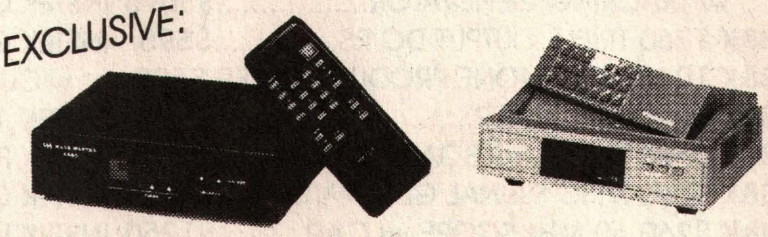
---

ATTENTION DEALERS: WHOLESALE ONLY!

JAMES' ELECTRONIC SERVICES, LTD.
Formerly JES, Inc.

BEST PRICES!
FAST SERVICE
SAME DAY SHIPPING

EXCLUSIVE:



2 PIECE SETUPS: $85^{00}

10 lot • 1 Year Warranty

Latest Technology • Universal Combo's - Ask For Details

CALL US LAST! LOWEST PRICES GUARANTEED!

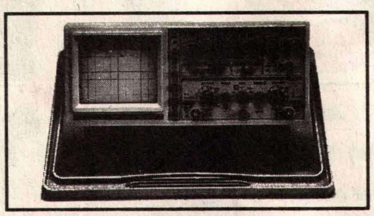
TOLL FREE:
800-375-3682

VISA MasterCard

FAX:
516-246-5634

New and Pre-Owned Test Equipment

Goldstar



Model OS-5100 → $899.00

Full 100 MHz Bandwidth!

- Dual-Channel, High Sensitivity
- TV Synchronization Trigger
- Calibrated Delayed Sweep
- Includes Two Probes, 2 Year Warranty

Spectrum Analyzer
Avcom PSA-37D

Satellite Downlink
Installation
Maintenance & Service

- Band 1 10 - 1750 MHz
- Band 2 3.7 - 4.2 GHz
- Built-in DC Block & Power for LNA/LNB's
- Line or Battery Powered

Only $2,475.00!

Pre-Owned Oscilloscope Specials

Tektronix 2213	60 MHz	$549.00
Tektronix 2215	60 MHz	$649.00
Tektronix 465	100 MHz	$599.00
Tektronix 465B	100 MHz	$729.00
Tektronix 475	200 MHz	$829.00
Tektronix 475A	250 MHz	$999.00

- Professionally Refurbished
- Aligned & Calibrated to Original Specifications
- The Industry Standard of Oscilloscopes
- **1 Year Warranty** - The Longest Available!!!

We Buy Surplus Test Equipment

Leader CATV Signal Level Meter Model LF 941
✓TV/CATV Coverage from 46 - 870 MHz
✓Video/Audio Carrier Measurements $695.00!

Just Released! → "Series III" Multimeters
Fluke Model 87III $319.00 !!!

SIMCHECK®II PLUS
Module Tester
* Tests SIMMs/168 p DIMMs
* Stand alone/portable
* Identifies Module properties
* Advanced Setup Capabilities
Only $2750.00!

See us on the Web!
www.fotronic.com

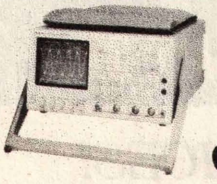
Test Equipment Depot

A FOTRONIC CORPORATION COMPANY
99 Washington St. Melrose, MA 02176
(781) 665-1400 • FAX (781) 665-0780
email: sales@fotronic.com

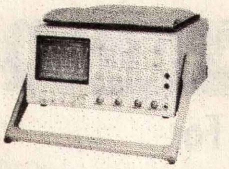
VISA MasterCard AMEX C.O.D.

(1-800-996-3837)
TOLL FREE 1-800-99-METER

CIRCLE 333 ON FREE INFORMATION CARD



Test Equipment Sales



Check out new B&K PRECISION and INSTEK !

B&K 5150 150 MHz 200MS/s DSO	$4695
B&K 2625 1 GHz SPEC. ANALYZER	$2395
B&K 2630 1 GHz SPEC. ANALYZER w/ TRACKING GENERATOR	$3095
B&K 1760 TRIPLE OUTPUT DC P.S.	$595
B&K 1045B TELEPHONE PRODUCT TESTER	$599
B&K 898 SIMM TESTER	$695
B&K 560B PROG. PC BOARD TESTER	$2750
B&K 1260 NTSC SIGNAL GENERATOR	$1795
B&K 2260 60 MHz SCOPE w/ C&R	$1250
B&K 2615A 500 MHz SPEC. ANALYZER	$1599

INSTEK GPC-3030 TRIPLE P.S.	$450
INSTEK GPC-3060 TRIPLE P.S.	$875
INSTEK GUT-6000A DIG. IC TESTER	$950
INSTEK GFC-8270 2.7 GHz COUNTER	$795
INSTEK GOS-658G 50 MHz SCOPE w/CURSORS &READOUT	$795
INSTEK APS-9100 1KW AC SOURCE	$3450
INSTEK PEL-300G PROG.LOAD	$1375
INSTEK GPR-6015D 60V 15A P.S.	$1995
INSTEK LCR-815B LCR METER	$1375
INSTEK GPS-3030D 30V 3A P.S.	$295

WE BUY SURPLUS

Ask about our line of new products including HP, LeCroy, Instek, Tektronix, Fluke and more !

M/C & VISA ACCEPTED

CALL 800 684-4651 OR FAX (603) 425-2945

CHECK US OUT AT WWW.TESALES.COM

CIRCLE 217 ON FREE INFORMATION CARD

Dalbani

www.dalbani.com

Amplifiers

$19.30

120 Watt
Seperate
Bass/Treble Switch

Item # 89-3470

Soldering Station

$34.95

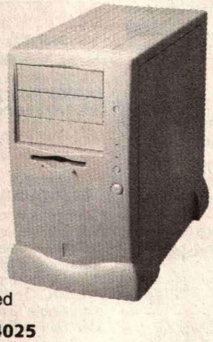
Variable Power
Control (5-40W)
Interchangable Tip
& Heating Element

Item# 51-1505

Computer Cases

Lexon®

$45.00



Nickel Chassis
with built in
250 power
supplies
7 ATX Slots
7 AT Slots

FCC Approved

Item # 95-4025

F-Quick Cable

$2.75

Gold Plated
3ft.,
75Ω

Item # 17-7395

MAGNAVOX

Remote Control

$5.95

Min. 5 pieces

Controls
3 Units
TV, VCR,
Cable Box

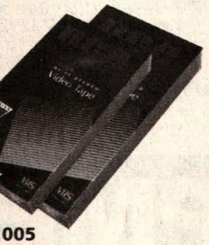
Item # 82-1380

RCA

Video Tapes

$1.25

Min. 10 pieces



6 Hours
Hi-Fi Sound

Item # 50-1005

SONY

PlayStation

$24.95

Minimum
3 pieces

Laser Pickup

Original Sony# KSM-440ACM

Item # 46-4720

GEMINI II

Power Strip

$3.45

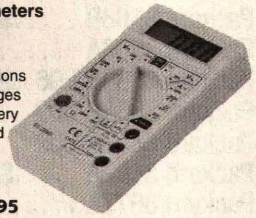
25 Joules
6 Outlets

Item # 40-1755

Multimeters

$7.95

6 Functions
19 Ranges
9V Battery
Included



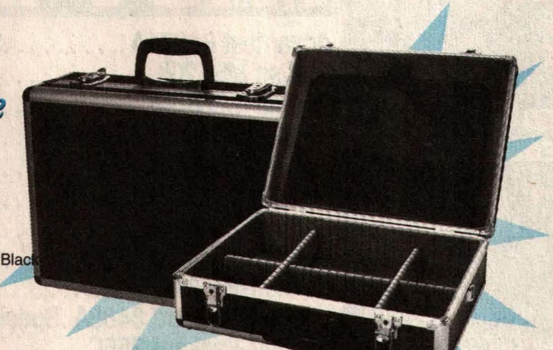
Item #
50-2895

Clearance

$24.95

Aluminum frame
Tool Case

Item# 50-1890 Black



CALL TOLL FREE

e-mail: savings@dalbani.com

1-800-325-2264

$20.00
Minimum Order
not including shipping & handling

UPS 2ND DAY AIR.

SPECIAL SHIPPING RATE

3.95 plus shipping and handling

Up to 5 lbs anywhere in the U.S.A.
Excludind Alacka, Hawaii & Puerto Rico.

CIRCLE 234 ON FREE INFORMATION CARD

AMAZING PRODUCTS! INFORMATION UNLIMITED DEPT GEN+ 1198

BOX 716 AMHERST, N.H. 03031

VISIT OUR "ACTION" WEB SITE@ http://www.amazing1.com

PLASMA BALLISTIC GUN

SHOOTS A HIGH VELOCITY PROJECTILE

Uses New Technology to Generate High Propellant Pressure Without Chemical Reactions

Velocitys Up To 3000 m/sec with 50mg Projectile!!
Easily Scaled Up or Down
Easy to Build-Kit and Parts Available
Approximately .16 Caliber Bore

Labelled Dangerous

PPR01 Plans, Parts Lists and Sources	**$20.00**

Includes Our **HEP Series** Plans Used for ***RAILGUNS, COIL GUNS, EMP LEVITATION, ANTIGRAVITY, MASS WARPING, LATTICE SNAPPING etc***

BURNING LASER RAY GUN

BLASTS THRU THE HARDEST OF METALS!

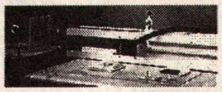
All Parts Available

A FUTURISTIC CONCEPT!!

LAGUN2 Plans	***$20.00***

BURNING CO2 BENCH LASER

HOTTER THAN MOST TORCHES!



Easy to Assemble

LC7 Plans	***$20.00***

TAKE CONTROL!!

ELECTRONIC HYPNOSIS & MIND MACHINES

Electronic Circuitry Induces Hypnotic as Well as ALPHA Relaxed States of the Mind. Place Subjects " Under" Your Control. Enhances Hidden PSYCHIC Ability in Many People!

MIND Plans	***$15.00***
MIND2K Kit and Plans	***$49.95***
MIND20 Assembled	***$89.95***

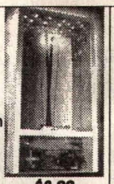
TELEPHONE TAPING SYSTEM

EXTENDED X4 PLAY

Tapes Both Sides of Phone Conversation - Check Laws!

TAP30X Ready to Use	***$84.95***
BEEP10 Beeper Alert	***$29.95***

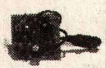
JACOBS LADDER



Observe a pyrotechnical display of "traveling" fieryplasma. Starts off as 1/2" arcand expands to over 3" before evaporating into space. This is an excellent attention getting display aswell as a winning science project!! With arc control.

JACK1 Plans	***$8.00***
JACK1K Kit Minus Case	***$129.95***
JACK10 Ready to Use	***$249.95***
12KVGEN20 Pwr Supply Only	***$99.95***
12KVGEN2K Kit of Pwr Supply	***$79.95***

3Mi FM VOICE TRANSMITTER



Safety Product Allows Listening to Children or Invalids in Hazardous Areas, Pools, Ponds etc. Great Security Intrusion Alert! Uses FM Table Top Radio. Become the local neighborhood D.J.

FMV1K Kit/Plans	***$39.95***

ALL NEW CYBERNETIC EAR!

Enhances Normal Hearing 3 to 4 Times. Provides That Extra "Edge" for Hunters Trackers Nature Enthusiasts

AdjustableVolume Control
Fits Into Either Ear
Built In Long Lasting Batteries

CYBEREAR Ready to Use	***$19.95***

MICRO TESLA COIL

Lights up a 4 ft Flourescent Tube Without Contact!!! Yet Only 3" Tall!

Super Magic Trick
Low Cost Science Project
12 VDC/115 VAC Operation

MTC1K Kit/Plans	***$19.95***
MTC10 Ready to Use	***$34.95***

PHASOR PAIN FIELD PISTOL

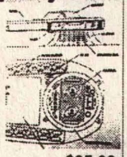
Blast out rats and rodents with high power Shock Waves Handheld and Battery Operated

PPPI Plans	***$8.00***
PPP1K Kit/Plans	***$49.50***
PPP10 Ready to Use	***$79.50***

HOVERBOARD PLANS

Research Project

Kit Soon to be Available



28 Pages of "how to" build a magnetic force field capable of containing a column of ionized air up to several psi! Includes theory on how to build a *HOVERBOARD* prototype capable of lifting 200 lbs.

HOVER Plans and Data	*$25.00*

TRANSISTORIZED TESLA COIL

TURNS A LIGHT BULB INTO A SPECTACULAR PLASMA DISPLAY

Transmits Wireless Energy.
Brush and Corona Discharge.
Noiseless Operation.
Pyrotechnic Effect.
12 VDC/5 Amps or Battery
115 VAC Optional Converter.
Adjustable Frequency
Control For Effect.

Shown With Oil Fill Option

TCL5 Plans	***$8.00***
TCL5K Kit/Plans	***$59.95***
TCL50 Ready to Use	***$109.95***
12DC/7 12VDC@7Amps	***$39.95***

1 800 221 1705 ORDERS ONLY! FAX 1 603 672 5406 INFO 9-5pm 1 603 673 4730 FREE CATALOG ON REQUEST

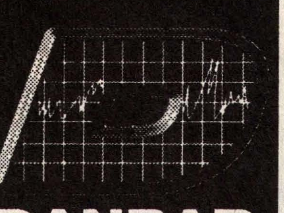
Pay by MC, VISA, Cash, Chk, MO, COD. Please Add $5.00 S&H plus $5.00 if COD. Overseas Please Contact for PROFORMA

Quality Reconditioned TEST EQUIPMENT

WANTED USED TEST EQUIPMENT

Advantest R3271A	$19,000.00	Hewlett-Packard 8562A	$19,500.0
Anritsu MS420K	$3,500.00	Hewlett-Packard 8566B	$29,500.00
Anritsu ME538M	$12,500.00	Hewlett-Packard 8568A	$8,900.00
Hewlett-Packard 3312A	$575.00	Hewlett-Packard 8568B/E96	$12,000.00
Hewlett-Packard 3325A	$1,250.00	Hewlett-Packard 8656B/002	$2,650.00
Hewlett-Packard 3336C	$1,250.00	Hewlett-Packard 8657A/002	$2,950.00
Hewlett-Packard 339A	$1,250.00	Hewlett-Packard 8662A	$25,000.00
Hewlett-Packard 3455A	$350.00	Hewlett-Packard 8672A	$7,500.00
Hewlett-Packard 3456A	$500.00	Hewlett-Packard 8901A/001	$1,750.00
Hewlett-Packard 3488A .Special	$550.00	Hewlett-Packard 8901B	$4,250.00
Hewlett-Packard 355C	$150.00	Hewlett-Packard 8903B	$2,500.00
Hewlett-Packard 355D	$150.00	Hewlett-Packard 8970A	$4,950.00
Hewlett-Packard 436A . .Special	$950.00	Rohde & Schwarz SME06	$27,500.00
Hewlett-Packard 438A .Special	$3,250.00	Tektronix 2213	$650.00
Hewlett-Packard 54603B	$1000.00	Tektronix 2235	$950.00
Hewlett-Packard 8350B	$2,000.00	Tektronix 2465 Special	$2,350.00
Hewlett-Packard 83522A	$4,250.00	Tektronix 2465A	$3,250.00
Hewlett-Packard 83525A	$5,900.00	Tektronix 2467	$4,350.00
Hewlett-Packard 83545A	$3,900.00	Tektronix 465	$590.00
Hewlett-Packard 83590A	$6,900.00	Tektronix 485	$895.00
Hewlett-Packard 83592B	$10,950.00	Tektronix 494P	$12,500.00
Hewlett-Packard 83594A	$14,700.00	Tektronix 520A	$895.00

Visit us at our website
www.danbar.com



DANBAR
SALES COMPANY

(602) 483-6202 • (602) 483-6403 Fax

14455 North 79th Street, Unit #C • Scottsdale, Arizona 85260

CIRCLE 235 ON FREE INFORMATION CARD

ALL ELECTRONICS
CORPORATION

QUALITY PARTS

FAST SHIPPING

DISCOUNT PRICING

CALL, WRITE, FAX or E-MAIL For A Free 96 Page CATALOG.
Outside the U.S.A. send $3.00 postage.

Koss Digital STEREO HEADSET

Koss MAC-5 Made for the Ford Motor Company for use in Windstar and Aerostar Vans. These lightweight, adjustable headsetshave great sound quality with great bass response for home or studio use. Supra-Aural foam ear cushions for hear-through sound and comfort. The 8' rubberized cords are terminated. Frequency response: 20-20,000 HZ. 1/4" stereo phone plug.

$12.50 each **CAT # HP-7**

3000 MCD ULTRA-BRIGHT RED LED

Everlight # 383URC-2/TR1-C(R) Red, "Ultra-bright" T 1 3/4 LEDs now at our lowest price ever. Due to a special purchase of "tape-and-reel" parts we are able to offer these LEDs at an incredibly low price when purchased on the reel. These are 5 mm diameter water-clear LEDs that light bright red at 20 ma.

CAT# LED-50

2 for $1.00

100 for $35.00
1000 for $250.00
(25¢ each)

S-VHS Tape (Used)

Super VHS tape users! Save a bundle on name-brand S-VHS, T-120 tapes. These tapes were used for a brief period, then bulk erased. The record-protect tabs have been broken out, so you will have to cover the notch with a piece of tape, but they work great and cost a fraction of the "new" price.

CAT #S-VHS **$3.00 each**

10 for $28.00 • 100 for $250.00

INCREDIBLY CHEAP!! Switching Power Supply

Voltek Corp # SPEC7188B
Input: 100 - 240 Vac
Outputs: + 5 Vdc @ 3.70 A,
+12 Vdc @ 0.60 A,
-5 Vdc @ 0.05 A,
+5 Vdc Trickle @ 0.1 A

Metal encased switching supply. Standard three-prong IEC socket power input. 7 conductor, Molex-type connector output. 9" x 2.1" x 1.36". UL recognized. Removed from new equipment.

CAT # PS-27 **$3.50 each**

10K THERMISTOR

Semitec # 103AT-2
10K ohm (± 1 %) @ 25 deg. C. Rated 10 mW. Time constant: 15 sec. 2 mm x 3mm. 2.5mm lead spacing. **CAT #THR-20**

$1.00 each

10 for $8.50
200 for $130.00

3 BUTTON Serial MOUSE

Windows compatible three button serial mouse. Includes 3.5" floppy disk with drivers.

$3.50 each

CAT #MSE-3

10 for $30.00

12 Vdc 800 mA Wall Transformer

2.5 mm co-ax plug, center positive.

Plugs directly into AC wall socket.

CAT# DCTX-1282 **$5.25 each**

10 for $45.00 • 100 for $400.00

20 Character X 4 Line LCD

Optrex # DMC 20434-CEM
(PWB 20434-CEM)
5 x 8 dot format.
3" x 1" viewing area.
3.88" x 2.38" module.
Removed from new equipment. May have felt padding on metal bezel. 14 pin single row header is pre-attached. Spec/hook-up sheet included.

CAT# LCD-46 **$7.00 each**

10 for $60.00

Encased Piezoelectric Element

0.82" DIAMETER X 0.15"
AVX/Kyocera # PCRT21BGX
Black plastic front, vented metal back. Solder loop terminals. Louder than non encased piezo elements. Requires external signal to produce sound. **CAT # PE-38**

3 for $1.00

100 for $25.00
1000 for $125.00

Rechargeable AA Cell NICKEL METAL HYDRIDE

Twice the capacity of standard nickel cadmium cells.
Nickel Metal Hydride batteries can be charged faster and don't have the "memory problems" associated with nickel-cads.
1.20 Vdc, 1200 ma
(0.56" dia. X 1.97")
CAT # NMH-AA **$3.00 each**

"Hi-8" Video Cassette

SONY Hi-8 Top quality, metal particle 120 minute video cassettes. *Used for a short time, then bulk-erased.* Each cassette has its own plastic storage box.

CAT # VCU-8 **$3.00 each**

10 for $28.00 • 100 for $250.00

ORDER TOLL FREE 1-800-826-5432

MAIL ORDERS TO:
ALL ELECTRONICS CORP.
P.O. BOX 567
VAN NUYS, CA 91408-0567

FAX (818) 781-2653 • INFO (818) 904-0524
INTERNET http://www.allcorp.com/
E-MAIL allcorp@allcorp.com

NO MINIMUM ORDER • All Orders Can Be Charged to Visa, Mastercard, American Express or Discover • Checks and Money Orders Accepted by Mail • Orders Delivered in the State of California must include California State Sales Tax • NO C.O.D • Shipping and Handling $5.00 for the 48 Continental United States - ALL OTHERS including Alaska, Hawaii, P.R. and Canada Must Pay Full Shipping • Quantities Limited • Prices Subject to change without notice.

Cards VISA MasterCard DISCOVER

MANUFACTURERS - We Purchase EXCESS INVENTORIES... Call, Write, E-MAIL or Fax YOUR LIST.

CIRCLE 214 ON FREE INFORMATION CARD

Weeder Technologies

VISA

Visit our
ON-LINE
CATALOG

MasterCard

Pro-Kit

PO Box 2426, Ft. Walton Beach, FL 32549 www.weedtech.com Voice/Fax 850-863-5723

Stackable RS-232 Kits

Digital I/O - 12 I/O pins individually configurable for input or output. DIP switch addressable; stack up to 16 modules on same port for 192 I/O points. Turn on/off relays. Sense switch transistions, button presses, 4x4 matrix decoding using auto-debounce and repeat. **$32**

Analog Input - 8 input pins. 12-bit plus sign self-calibrating ADC. Returns results in 1mV steps from 0 to 4095. Software programmable alarm trip-points for each input. DIP switch addressable; stack up to 16 modules on same port for 128 single-ended or 64 differential inputs. **$49**

Home Automation (X-10) - Connects between a TW523 and your serial port. Receive and transmit all X-10 commands with your home-brewed programs. Full collision detection with auto re-transmission. **$39**

Caller ID - Decodes the caller ID data and sends it to your serial port in a pre-formatted ascii character string. Example: "12/31 08:45 850-863-5723 Weeder, Terry <CR>". Keep a log of all incoming calls. Block out unwanted callers to your BBS or other modem applications. **$35**

Touch-Tone Input - Decodes DTMF tones used to dial telephones and sends them to your serial port. Keep a log of all outgoing calls. Use with the Caller ID kit for a complete in/out logging system. Send commands to the Home Automation or Digital I/O kits using a remote telephone. **$34**

Telephone Call Restrictors

Two modes of operation; either prevent receiving or placing telephone calls (or call prefixes) which have been entered into memory, or prevent those calls (or call prefixes) which have "not" been entered.

Block out selected outgoing calls. Bypass at any time using your password. **$35**

Block out selected incoming calls. Calls identified using Caller ID data. **$46**

Phone Line Transponder

7 individual output pins are controlled with buttons 1-7 on your touch-tone phone. Automatically answers telephone and waits for commands. Monitor room noises with built in mic. "Dial-Out" pin instructs unit to pick up phone and dial user entered number(s). Password protected. **$49**

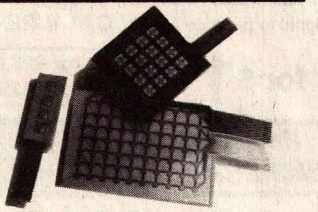
IR Remote Control Receiver

Learns and responds to the data patterns emitted by standard infrared remote controls used by TVs, VCRs, Stereos, etc. Lets you control all your electronic projects with your TV remote. 7 individual output pins can be assigned to any button on your remote, and can be configured for either "toggle" or "momentary" action. **$32**

DTMF Decoder/Logger

Keep track of all numbers dialed or entered from any phone on your line. Decodes all touch-tones and displays them on a 16 character LCD. Holds the last 240 digits in a non-volatile memory which can be scrolled through. Connect directly to radio receiver's speaker terminals for off-air decoding of repeater codes, or numbers dialed on a radio program. **$55**

MEMBRANE SWITCHES



Stock Layouts!

Eliminates tooling cost...

****From 2 to 128 keys****

Industrial/Commercial/ Prototyping

Popular types are available as complete *kits*, with bezel, connector & overlay!

4 key DSK-4 **kit** ***$9.60***
12 key DSK-12 **kit** ***$13.87***
many more layouts...

Optional Stainless Steel "Clickdomes".

Sil-Walker
(805) 491-0654
FAX (805) 491-2212
P.O. Box 3220
Camarillo, CA 93011-3220
silwkr@vcnet.com
www.vcnet.com/silwkr/

MASTERCARD/VISA

5 Axis Robotic Arm $195.00 *Plus S&H*

Lynxmotion

You can build this Robotic Arm
Impressive, fast, accurate, and repeatable motion. Any computer or micro capable of sending 2400 or 9600 baud serial data can control the arm. It can even be controlled from a Basic Stamp. This robot arm makes a great foundation for many AI and motion control experiments. Position the arm in an X, Y, Z, grid with a joystick or keyboard using the new RoboMotion for Windows. The kit includes the hardware, structural components, Hitec servos, pre-assembled SSC servo controller, DOS and Windows software, and an illustrated assembly manual. Camouflage paint not included.

We have many more cool robots, check out our web page or ask for our free catalog!

Lynxmotion, Inc.
104 Partridge Road
Pekin, IL 61554-1403
www.lynxmotion.com

MasterCard VISA

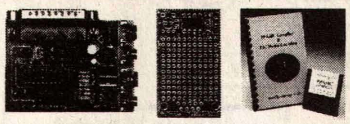
Tel: 309-382-1816
Fax: 309-382-1254
sales@lynxmotion.com
tech@lynxmotion.com

FOR 26 EASY WAYS to HELP SAVE THE EARTH CALL 1-800-488-8887.

A Public Service of This Publication

Earth Share

Low Cost PICmicro Tools



EPIC Pocket PIC Programmer - $59.95
- Programs PIC12C50x, 67x, 16C55x, 6x, 7x, 8x

PICProto Boards - $8.95 to $17.95

PicBasic Compiler - $99.95

***new*! PicBasic Pro Compiler - $249.95**

BASIC makes it easy for you to program the fast and powerful Microchip PIC microcontrollers.
- Expanded BS1/2 compatible instruction set
- True compiler provides faster program execution and longer programs than BASIC interpreters

microEngineering Labs, Inc.
Box 7532 Colorado Springs CO 80933
(719) 520-5323 fax (719) 520-1867
http://www.melabs.com

VISA NOVUS

Great consumer information is a shoe-in with our free Catalog.
Call toll-free 1 (888) 8-PUEBLO or go to www.pueblo.gsa.gov.

BUGGED??

EAVESDROPPING is unbelievably widespread! Electronic Devices with amazing capabilities can be monitoring your telephone and room conversations RIGHT NOW! Are you sure you're safe? **FREE CATALOG tells you fast!** Includes Free Bonus details on fantastic opportunities now open in Counter-Surveillance field. Exciting, immensely interesting and EXTREMELY profitable (up to $250 hr) full/part-time income. Call Now! 1-800-732-5000

SINGERS! REMOVE VOCALS
Unlimited, Low Cost, Instantly Available Background Music from *Original Standard* Recordings! Does Everything Karaoke does...*Better and* gives you the **Thompson Vocal Eliminator™**
Free Brochure & Demo Tape.
LT Sound Dept EN
7988 LT Parkway, Lithonia, GA 30058
Internet-http://www.LTSound.com
24 Hour Demo/Info Request Line (770)482-2485 - Ext 72
When You Want Something Better Than Karaoke!

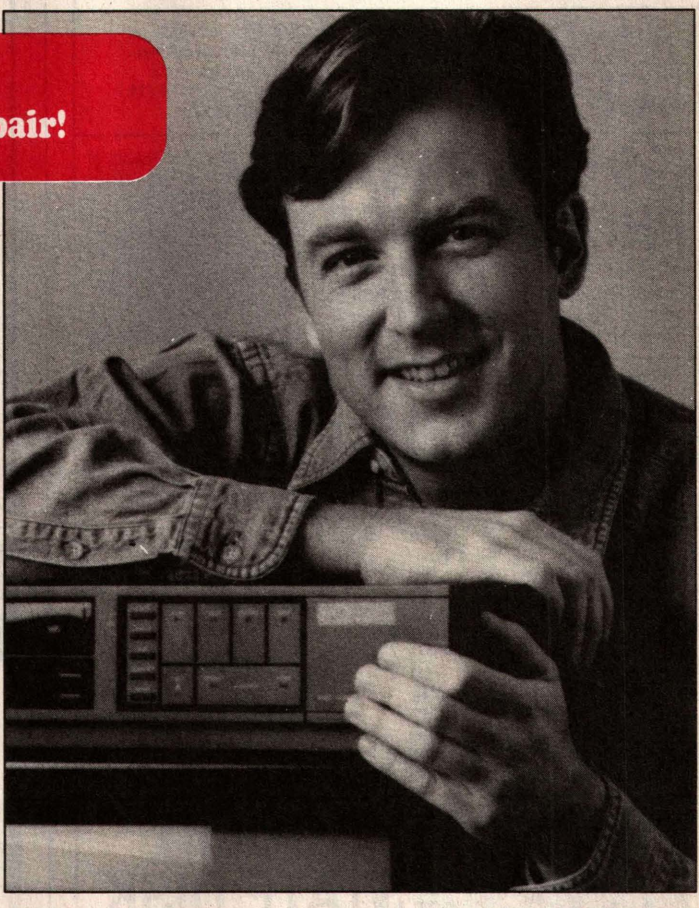
CABLE EQUIPMENT
LOW, LOW WHOLESALE PRICES!
1-800-521-0512

New 1-piece Jerrold - 5 units $109/ea; 10 u. $99/ea; 20 u. $89/ea.
New RFT-M - 5 units $109/ea; 10 u. $99/ea; 20 u. $89/ea.
Basic Converter - 5 units $75/ea; 10 u. $65/ea; 20 u. $55/ea.

WHOLESALE ELECTRONICS
Check out our website: www.whe.net

"I earned $1,000 on just 12 VCR repairs in one week"

A true statement by Paul B. of San Pedro, California*



How to cash in on skyrocketing field of VCR repair!

You too can earn up to $85 an hour, pocket $200 a day, double your income...in the high-profit field of VCR repair...part-time or full time. There are over 77 million VCR's currently in use in America today – a lot of business out there just waiting for you!

Here is a once-in-a-lifetime opportunity to go into a booming business of your own, make really big money starting right away, be your own boss and enjoy financial freedom and security.

It's easy to learn VCR cleaning, maintenance and repair at home in just a few short weeks through Foley-Belsaw's unique method which emphasizes the mechanics involved in 90% of all repairs, without dwelling on all the unnecessary basic electronics. This exclusive practical hands-on course was developed and proven over a long period of time in an actual VCR repair shop. It combines simple step-by-step lessons with easy-to-follow video cassette guidance. No special experience or electronics background is necessary. Just average mechanical aptitude and the ability to follow simple A-B-C repair procedures that are clearly outlined for you. And when you complete the course you will receive the School's official diploma attesting to your expertise.

Send coupon today for FREE Fact Kit. No obligation.

Don't miss out on this opportunity to give your income a tremendous boost. Send in the coupon NOW. Get all the facts and study them in the privacy of your own home. There's absolutely no obligation and no salesmen will call on you. So don't delay. Mail the coupon today!

> **"I started 3 months ago, now earn over $900 a week."**
> **D.K., New York, NY**
>
> **"Took in over $3,200 in the past 10 days!"**
> **H.H., Denver, CO**
>
> **"Doubled my income within 6 weeks."**
> **R.B., Bakersfield, CA**

*Last name withheld by request.

MAIL TODAY FOR FREE INFORMATION PACKAGE

Foley-Belsaw Institute,
6301 Equitable Road
Kansas City, MO 64120-1395

FOLEY BELSAW

CHECK ONE BOX ONLY FOR FREE INFORMATION KIT!

☐ **YES,** without obligation send me information on how I can learn at home to become a VCR technician. 62927

☐ TV/Satellite Dish 31698
☐ Electrician 95506
☐ Computer Spefcialist 38463
☐ Computer Repair 64836
☐ Computer Programmer 35645
☐ Networking Specialist 39450

Name ______________________________

Address ______________________________

City ____________________ State ________ Zip ____________

CIRCLE 335 ON FREE INFORMATION CARD

386 MINI-PC $83

1K PRICE
EVAL $295
8088 $27

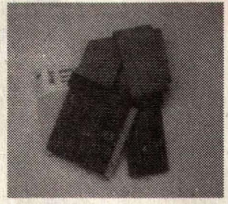
includes:
- -5 Serial,3 Parallel (32bit max)
- -Up to 8 meg ROM (27C080)
- -32k RAM exp. to 64Mbyte
- -Battery backed RT Clock
- -LCD and Keyboard ports
- -IRQ x15, DMA x2, TIMER x4
- -On-board LED display
- -Industry Standard PC Bus

Perfect when a full-size PC is too large, expensive, or power hungry. A fully functional single board computer, needs only program and power source. Runs DOS / WINDOWS. Use Turbo C, BASIC, MASM. All utilities to do this included.

A to D D to A CONVERTERS

For PC or SBC
8,12,16 bit resolution
up to 24 channels
starting at $21 OEM (1k)
eval kit $75

$95 UNIVERSAL PROGRAMMER



FLASH, EEPROM, NVRAM, EPROM up to 8 meg (27C64-080). Adapters for micros, PLCC, etc. Parallel port version for notebook. FAST AND EASY TO USE.

LOW COST... LOW POWER...

LOW RISC!

QTY 1K PRICE
$1.99
EVAL KIT 7.00

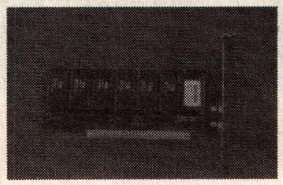
LOWER COST, FASTER, EASIER TO PROGRAM SINGLE CHIP COMPUTER

COMPARE:	16C54	MV1200
OEM (1K) PRICE	$2.57	$1.99
RS232 PROGRAM DOWNLOAD	NO	YES
SINGLE CHIP OPERATION	NO	YES
BUILT-IN BASIC	NO	YES
EEPROM DATA MEMORY	NONE	64
PROGRAM MEMORY	768 OTP	1K FLASH
MATH REGISTERS	1	32
MAX INSTRUCTIONS / SEC	5M	20M
MAX COUNTER BITS	16	18
INPUT / OUTPUT BITS	12	15
A TO D COMPARATOR	NO	YES
HARDWARE INTERRUPTS	NONE	3

PINOUT:

RESET	1	20	VCC
PD0	2	19	PB7
PD1	3	18	PB6
XOUT	4	17	PB5
XIN	5	16	PB4
PD2/INT	6	15	PB3
PD3	7	14	PB2
PD4/TMR	8	13	PB1/AD1
PD5	9	12	PB0/AD0
GND	10	11	PD6

- LONG WORD INSTRUCTION - FRIENDLY SYMMETRIC ARCHITECTURE -



PC SOLID STATE DISK

$21 **OEM (1k) eval kit 75.00**
FLASH / RAM / EPROM
256K-16M PCMCIA/DIPS

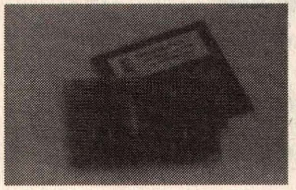
No More Hangups...

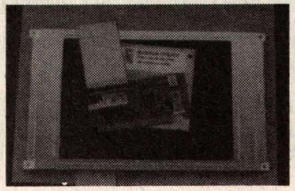
PC WATCHDOG!

Reboots PC OEM $21 EVAL $75

VGA LCD

640x480 controller for PC or SBC $27 oem $95 eval combo LCD/CRT version available





visit our web site: www.mvsweb.com

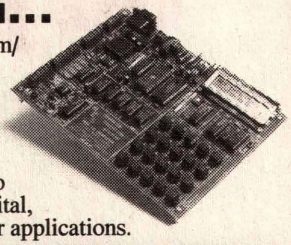
MVS BOX 850
MERRIMACK,NH 03054
(508) 792-9507

MVS

5yr Limited Warranty
Free Shipping
Hrs: Mon-Fri 10-6 EST

CIRCLE 304 ON FREE INFORMATION CARD

Learn MICROCONTROLLERS EMBEDDED SYSTEMS and PROGRAMMING...



...with the AES learning system/ embedded control system. Extensive manuals guide you through your development project. All programming and hardware details explained. Complete schematics. Learn to program the LCD, keypad digital, analog, and serial I/O. for your applications.

THREE MODELS AVAILABLE. Choose from an Intel 8051, Intel 8088, or Motorola 68HC11 based system. All models come with:

• 32K Byte ROM, 32K Byte RAM • 2 by 16 Liquid Crystal Display • 4 by 5 Keypad • Digital, Analog, and Serial I/O • Interrupts,timers, chip-selects • 26 pin expansion connector • Built-in Logic Probe • Power Supply (can also be battery operated) • Powerful ROM MONITOR to help you program • Connects to your PC for programming or data logging (cable included) • Assembly, BASIC, and C programming (varies with model) • Program disks with Cross Assembler and many, well documented, program examples • User's Manuals: cover all details (over 500 pages) • Completely assembled and ready to use • Source code for all drivers and MONITOR • Optional Text Book

Everything you need. From $279.
Money Back Guarantee

Call for Free Info Pack, or see
WEB at http://www.aesmicro.com
714-550-8094, FAX 714-550-9941

AES
Advanced Educational Systems

Call 1-800 -730-3232

AES 575 ANTON BLVD., SUITE 300, COSTA MESA, CA 92626, USA

CAD FILES TO CASH PILES

IMAGINE THE POSSIBILITIES!

STARTING AT $895.00

NOW YOU CAN TURN YOUR *DREAMS* INTO REALITY!

3 AXIS UNITS FROM 12" X 12" TO 60" X 60" MACHINING AREAS

THE

ROBOPRO X50

CNC ROBOTIC MACHINING SYSTEM

YOUR WISH IS ITS COMMAND!

FREE 3D CAD/CAM

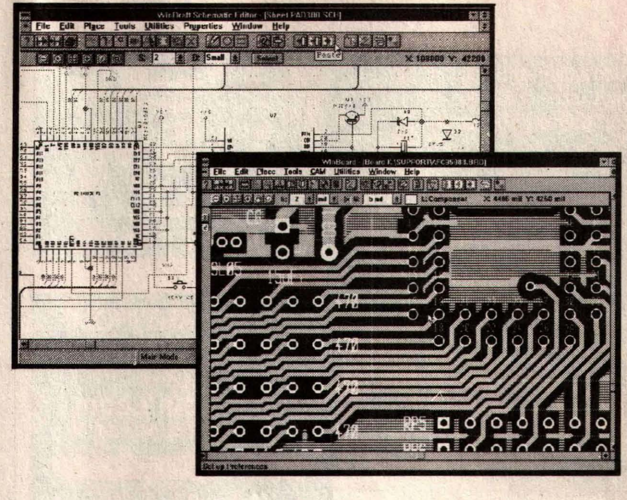
ROUTE, MILL, DRILL, CARVE,
ENGRAVE, PAINT, ETC. . . .
IN WOOD, PLASTIC, VINYL,
PC BOARD, & LIGHT METALS

U.S. CYBERLAB, INC., 14786 SLATE GAP ROAD
WEST FORK, AR 72774 (501) 839-8293

Visit us at www.uscyberlab.com

Electronic CAD for Windows

Professional Windows EDA tools at an affordable price with powerful features to make designing faster. WinBoard PCB layout delivers sophisticated interactive routing for complex designs, plus it has the tools needed for high-speed circuits, analog, RF and SMT designs.


WinDraft Schematic Editor - [Sheet PAD300.SCH]
File Edit Place Tools Utilities Properties Window Help
Paste
Small
Select
X: 109000 Y: 42200
WinBoard - [Board K:\SUPPORT\VFC35983.BRD]
File Edit Place Tools CAM Utilities Window Help
L.Component
X: 4486 mil Y: 4260 mil

WinDraft® Schematics

- Use True-Type fonts. Quickly copy and paste into other applications.
- Supports hierarchical designs, electrical rules checking, Annotation & Bill of Materials.
- Thousands of library parts and symbol editor included.

WinBoard™ PCB layout

- Supports 16 layers, multiple copper pours, and advanced features for RF designs.
- SMD & through hole library with on-line graphical editor.
- CAM outputs include BOM, in-circuit test, NC Drill, Gerber, Pick & Place, & Advanced Design Rule Checking (DRC).

With our unique ***pin capacity*** versions you only pay for what you need. You choose the base configuration to suit your needs today, and expand that configuration to handle increased pin capacity as your design requirements change.

WinDraft 2.0 Available Now

$ 250	**WinDraft or WinBoard - P650**
$ 495	**WinDraft or WinBoard - unlimited**
$ 895	**WinBoard P650 with CCT Specctra® autorouter.**

Thousands of satisfied customers are using this new generation of powerful and affordable Windows EDA tools from Ivex. Your satisfaction is guaranteed!

World Wide Web: http://www.ivex.com

Information and free evaluation version is available on the Ivex WW Web, FTP and BBS.

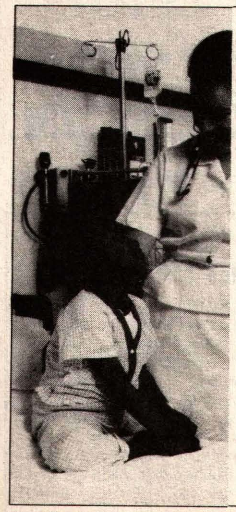
Tel: (503) 531-3555
Fax: (503) 629-4907
BBS: (503) 645-0576

IVEX™ DESIGN INTERNATIONAL

Ivex Design International. 15232 NW Greenbrier Parkway. Beaverton, Oregon 97006. USA.

ADV2_1

CIRCLE 319 ON FREE INFORMATION CARD



Precious Life

Not too many years ago, this nurse was a patient at St. Jude Children's Research Hospital. She fought a tough battle with childhood cancer. And won.

Until *every* child can be saved, our scientists and doctors must continue their research.

To find out how you can help, call **1-800-877-5833.**

ST. JUDE CHILDREN'S RESEARCH HOSPITAL
Danny Thomas, Founder

EPROM+

A device programming system
for design, repair and experimentation

- ◆ *EXCEPTIONAL POWER FOR THE PRO*
- ◆ *EASY-TO-USE FOR THE NOVICE*
- ◆ *INCLUDES STEP-BY-STEP TUTORIAL*

Here's what you get: A rugged, portable programming unit including the power pack and printer port cable both of which store inside the case. A real printed user and technical manual which includes schematic diagrams for the programming unit plus diagrams for all technology family adapters.* Comprehensive, easy-to-use software which is specifically designed to run under DOS, Windows 3.1, 95 and 98 on any speed machine. The software has features which let you **READ, PROGRAM, COPY** and **COMPARE** plus much more. You have full access to your system's disk including **LOADING** and **SAVING** chip data plus automatic processing of **INTEL HEX, MOTOROLA S-RECORD** and **BINARY** files. For detailed work the system software provides a full screen **buffer editor** including a comprehensive **bit and byte tool kit** with more than 20 functions.

Broad device support: **FIRST GENERATION EPROMS** (2708, TMS2716*, 25XX)
SECOND GENERATION EPROMS (2716-28C080). **40 AND 42 PIN EPROMS*** (27C1024-27C160)
FLASH EPROMS (28F,29C,29EE,29F). **EEPROMS** (2816-28C010). **NVRAMS** (12XX,X2210/12)
8 PIN SERIAL EEPROMS* (24, 25, 85, 93, 95, 80011A) PLUS **ER1400/M58657*** AND **ER5901**
BIPOLAR PROMS* (72S/82S). **FPGA CONFIGURATORS** (17CXXX)
MICROCONTROLLERS* (874X, 875X, 87C5XX, 87C75X, 89C5X)
ATMEL MICROS* (8-40) PIN 89CX051, 89SXXXX **(AVR)** 90SXXXX
PIC MICROS* 8, 18, 28, 40 PIN (12CXXX-16CXXX, 16FXX, 17C)
MOTOROLA MICROS* (68705P3/U3/R3, 68HC705, 68HC711)

$289

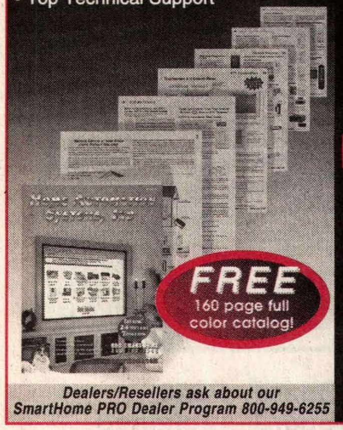
*REQUIRES SNAP-IN ADAPTER (ORDER FACTORY DIRECT OR BUILD YOURSELF)
1 YEAR WARRANTY - 30 DAY MONEY BACK GUARANTEE

$5.00 SHIPPING • $5.00 C.O.D.
VISA•MASTERCARD•AMEX

ANDROMEDA RESEARCH, P.O. BOX 222, MILFORD, OH 45150
(513) 831-9708 FAX (513) 831-7562 website - www.arlabs.com

Home Automation

- World's Largest Selection!
- Best Customer Service
- Top Technical Support



FREE
160 page full color catalog!

Take a step into the future -- discover the latest in innovative home technology, from remote controls to high-tech toys to voice-activated systems. We will show you the *smart* (and easy!) way to automate your home.

Lowest Prices Guaranteed!

Call 800-SMART-HOME
800-762-7846

or visit us on the web@
smarthome.com
to order your *FREE* catalog today!

Order 24 Hours • 7 Days

HOME AUTOMATION SYSTEMS, INC.

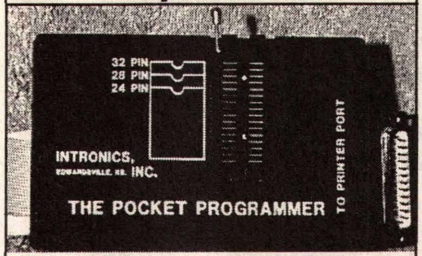
Dealers/Resellers ask about our SmartHome PRO Dealer Program 800-949-6255

Help protect our nation's soil and water. Call for your free action packet.

1-800-THE-SOIL
WE OWE IT TO OUR CHILDREN

United States Department of Agriculture
Soil Conservation Service

The Pocket Programmer
Only $129.95



The portable programmer that uses the printer port of your PC instead of a internal card. Easy to use software that programs Eprom, EEprom, Flash & Dallas Ram. 27(C) / 28(C) / 28F / 29F / 29C & 25XX series from 16K to 8 Megabit with a 32 pin socket. Adapters available for Pic, PLCC, 5-Gang, 874X, 875X MCU's, 40-Pin X 16 & Serial Eprom's, 82/74 Prom's and Eprom Emulator to 32K X 8.

Same Name, Address & Phone # for 16 Years... Isn't it Amazing ?

Intronics, Inc.
Box 13723 / 612 Newton St.
Edwardsville, KS 66113 Add $5.00 COD
Tel. (913) 422-2094 Add $4.00 Shipping
Fax (913) 441-1623 Visa / Master Charge

Whaddya Say To A Guy Who's Had The Same Job For 50 Years, Has Never Called In Sick Or Showed Up Late, Never Taken A Vacation Or A Holiday, Never Asked For A Raise Or Griped About His Bonus And, Believe It Or Not, Has No Plans For Retirement?

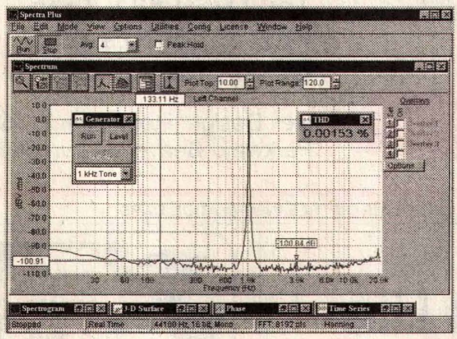
Thanks.

Remember - only you can prevent forest fires.

Turn Your Multimedia PC into a Powerful Real-Time Audio Spectrum Analyzer

Features

- 20 kHz real-time bandwith
- Fast 32 bit executable
- Dual channel analysis
- High Resolution FFT
- Octave Analysis
- THD, THD+N, SNR measurements
- Signal Generation
- Triggering, Decimation
- Transfer Functions, Coherence
- Time Series, Spectrum Phase, and 3-D Surface plots
- Real-Time Recording and Post-Processing modes



Applications

- Distortion Analysis
- Frequency Response Testing
- Vibration Measurements
- Acoustic Research

System Requirements

- 486 CPU or greater
- 8 MB RAM minimum
- Win. 95, NT, or Win. 3.1 + Win.32s
- Mouse and Math coprocessor
- 16 bit sound card

Priced from $299

(U.S. sales only – not for export/resale)

DOWNLOAD FREE 30 DAY TRIAL!
www.spectraplus.com

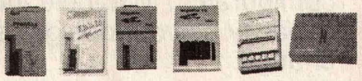
PHS Pioneer Hill Software
24460 Mason Rd.
Poulsbo, WA 98370
a subsidiary of Sound Technology, Inc.

Spectra Plus
FFT Spectral Analysis System

Sales: (360) 697-3472 *Fax: (360) 697-7717* *e-mail: pioneer@telebyte.com*

PROGRAMMERS OVER 50 MODELS

ADVANTECH EETOOLS NEEDHAMS DATA I/O ICE TECHNOLOGY HILO SYSTEM GENERAL CHROMA MODULAR CIRCUIT TECHNOLOGY XELTEK

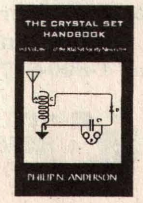

PROMAX EMP-20 MEGAMAX MEGAMAX4 SIMM/SIP TESTER EMUPA

CALL	ADVANTECH LABTOOL	599	EETOOLS SIMMAX
629	ICE TECH MICROLV	795	CHROMA SIMM/SIP
650	EETOOLS ALLMAX +	359	MOD-MCT-EMUPA/R
409	EETOOLS MEGAMAX	279	MOD-MCT-EMUP/R
509	EETOOLS MEGAMAX4	49	EPROM 1G TO 512K
369	XELTEK SUPERPRO II	69	EPROM 1G TO 1MEG
409	XELTEK SUPERPRO II P	99	EPROM 4G TO 1MEG
249	XELTEX SUPERPRO L	199	EPROM 16G TO 1 MEG
165	XELTEK ROMMASTER II	89	EPROM 1G TO 8MEG
479	MOD-MCT-EMUPA	129	EPROM 4G TO 8MEG
739	STAG ORBIT-32	250	EPROM 8G TO 8MEG

LABTOOL48 MICROMASTER SUPERPRO ALLMAX PLUS ROMMASTER2

General Device Instruments
Sales 916-393-1655 Fax 916-393-4949 BBS 983-1234
Web www.generaldevice.com E-Mail icdevice@best.com

Get your copy of the
CRYSTAL SET HANDBOOK



Go back to antiquity and build the radios that your grandfather built. Build the "Quaker Oats" type rig, wind coils that work and make it look like the 1920's! Only **$10.95** plus **$4.00** for shipping and handling. **Claggk Inc., P.O. Box 4099, Farmingdale, NY 11735.** USA Funds ONLY! USA and Canada—no foreign orders. Allow 6-8 weeks for delivery. MA01

PROFESSIONAL DESOLDERING with the World's Best
Transportable, Totally Self-Contained Desoldering Tool

Now Get

More Vacuum

Mike Murphy - Service Center - Van Nuys CA 818-785-7805
The single best investment of repair equipment we've made. It outperforms all other desoldering tools we've used. Easier to use and least expensive.

Dick Manning - Dicks Electronics - Hartland WI 414-367-8339
The ease & speed of component removal greatly increases productive time. The SMD kit makes SMD removal a breeze, even for inexperienced Techs.

Quicker Vacuum

Don Scott - LAV Electronics - Healeah-Miami Lakes FL
I am a constant user of the SC7000 Desoldering Tool and for quick component removal, this unit has no equal. It also comes with excellent company support. I am very satisfied and highly recommend it to anyone in the servicing field.

George Hefner - Hefner Electronics - Coleridge NE 402-283-4333
Being a one-men service center, I hesitated to spend the money on a desoldering tool, however all that changed when I nearly ruined a $400 computer logic board. It has cut my desoldering time by 50%.

Higher Temperature

Don Cressin - Certified Electronics Service - Ellicott City MD 301-461-8008
We have obtained excellent results with the SC7000 including repairing high density U/V tuners. It is one of the best purchases we have made.

Doug Pettit - LuRay Electronics - LuRay VA 703-743-5400
We found that the SC7000 not only saves money vs. wick, but saves valuable time in troubleshooting. It allows you to be more accurate in removing SMD's.

FREE TRIAL
Available on Request

Price includes stand worth $25.00 one extra filter, and two tip cleaners.

Timothy Kraft - Monikraft, Inc.
Cherry Hill NJ 609-751-3252
We replaced all our existing desoldering stations with the SC7000. Our technicians are very pleased with the improved performance, portability, and reliability over our previous higher priced equipment.

Bill Warren CET/CSM - Warrens Audio & Video - Knoxville TN - 234-546-1128
We have been extremely satisfied with the quality and durability of the DEN-ON SC7000 as well as with after the sale support.

Keith Sahs - J & M Electronics
Omaha NE 402-291-7100
It's a must tool for my bench. I can desolder multiple pin IC's quickly and clean. It will even take up large solder amounts on tuner and case grounds.

Sale Price
$395.00

For More Info
and 5% Savings Go To
http://www.heinc.com/sc7000zb.html

New Features

- Totally Self Contained diaphragm vacuum pump and AC motor for high vacuum suction or reversible hot air blow for SMD removal.
- 100 Watt Ceramic heater with zero-crossover switching heater control circuit which prevents spikes and leakage currents.
- Unique patented long lasting filter cartridge design. Solder builds up on easily cleaned baffle, while air flows around the outside of baffle.
- Totally ESD Safe. The housing contains carbon and the tip is at ground potential for complete ESD Protection.

Howard Electronic Instruments, Inc.
6222 N. Oliver Kechi, KS 67067

New Specifications

- **Voltage**—AC 100v, 120V, 230V, 50/60 HZ
- **Power Consumption**—120W
- **Pump**—Diaphragm Type
- **Motor Output**—12W
- **Vacuum Attained**—**650mm Hg**
- **Temperature Range**—300° C—**500° C** (572° F—**932° F**)
- **Air Flow Rate**—15 Liter/Minute (Open)
- **Heater**—100W (Ceramic)
- **Control System**—Feed Back Zero Cross-over Type
- **Net Weight**—420 Grams

Visa - M/C - Discover - American Express - Terms to Qualifying Companys
30 Day Money Back Total Satisfaction Guarantee - One Year Parts and Labor Warranty

HOWARD
ELECTRONIC
INSTRUMENTS INC
Your Desoldering Specialists

Toll Free U.S. and Canada
1-800-394-1984

Web Site www.heinc.com
E-Mail sales@heinc.com
International (316) 744-1993
or Fax (316) 744-1994

CIRCLE 331 ON FREE INFORMATION CARD

Excellence
since
1934
H&R
COMPANY

HERBACH AND RADEMAN

Products for Science and Industry

THIS MONTH

OUR CATALOG IS LIMITED ONLY BY YOUR IMAGINATION ...

Tri-Layer Solar Panel

3.0 WATTS Rated 40 Volts DC Open Circuit

Size 12 x 12 x 1/8"

Amorphous silicon resin, glass encapsulated. Operating voltage 24VDC at 100mA in bright sunlight with short circuit current of 200mA. Supplied with connector clips. Use for battery charging and other solar panel applications, or experiments. New. Wt. 3 lbs.

TM98SED3180 -- $19.95

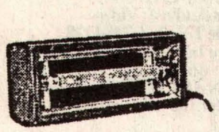
Reversible DC Gearhead Motor

24 VDC 700 mA 750 RPM

Pittman #GM8714F560-R1... Motor/gearbox may be used at lower voltage with a corresponding reduction in torque and RPM. Torque is approx. 60 oz/in @750 RPM. Gearhead is 1.375" dia. Shaft is 0.185" dia. x approx 0.430"L with removable gear. Mounting holes on shaft end are #4-40 UNC-2B. Motor size : 1.175" dia. x 3.300" long. New. Shpg Wt, 1 lb.

TM98MTR3138 -- $21.95

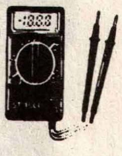
ULTRA-VIOLET LAMP



Unit can illuminate counterfeit prevention bands on the new fifty and hundred dollar bills. Features On/Off push button switch and stays lit for approx. 1 min. Includes wall transformer, 120V AC input (12V DC 500mA output) and bulb #F4T5 BLB. Size: 7"L x 3-1/4"W x 2-1/2"H. New. Shpg wt 2 lbs.

TM98UVL3196 -- $8.95

3-1/2" DIGITAL MULTIMETER



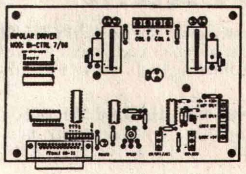
Display: 3.5 digit LCD, 0.5"high with polarity, 5 DC voltage ranges 200mV, 2000mV, 20V, 200V and 1000V. Five DC current ranges 200 µA, 2000 µA, 20mA, 200mA and 10A. Overload protection. Two AC voltage ranges 200V and 750V. Five resistance ranges 200W, 2000W, 20KW, 200KW and 2000KW. Diode and transistor test capability. Size: 2-3/4" W x 1" H x 5" L. New. Shpg wt 1 lb.

TM97TLE2992 -- $13.95

Exclusively designed for H&R

BI-POLAR STEPPING MOTOR CONTROL

Controls Motors from 1 to 50 Volts, up to 2 Amps



Interfaces with Any IBM/clone parallel printer port for computer control. Up to 4 boards can be daisy-chained for control from one printer port.

THIS BOARD PROVIDES BOTH COMPUTER, AND ON-BOARD CONTROL OF 4, 6, AND 8 WIRE BI-POLAR STEPPING MOTORS. It controls motors from 1 to 50 volts @2 amps continuous / 3 amps peak current. The bi-polar controller uses chopped current regulation and back-EMF protection. An on-board switch selects stand-alone or computer controlled operation. It provides CLOCKWISE, COUNTER CLOCKWISE, JOG, SPEED, AND STOP control.

This unit is a current regulating controller. Stepping motors perform most efficiently from operating voltages 2 to 3 times the coil's rated voltage. The chopped current regulation maintains the manufacturere;s motor specs. (User must select an appropriate value current sensing resistor from an included table, and solder it onto PC board).

Includes BASIC software that demonstrates dual phase and half step control. Accepts CMOS, TTL, or mechanical switch input. Requires two power supplies (not included). A) 5V 200ma logic supply. B) up to 50 volts @ 3.5 amps for stepping motor coils. New. Shpg wt. 2 lbs.

TM98CTL3145 -- $59.95

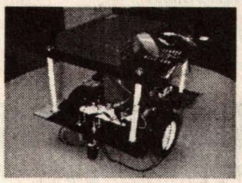
ORDER TOLL FREE 24 HRS **1-800-848-8001**
609-802-0465 • 24 HR FAX 609-802-0422 • OFFICE

VISA MasterCard Discover

INTERNET http://www.herbach.com E-mail - sales@herbach.com

CIRCLE 337 ON FREE INFORMATION CARD

Zagros Robotics
World Class Engineering and Programming



PO Box 460342
St. Louis, MO 63146-7342
(314)768-1328
info@zagrosrobotics.com
www.zagrosrobotics.com

FCC License Preparation

Electronics Tech., Avionics, Marine & Radar
HOMESTUDY—Fast, Easy & Inexpensive
Manuals, Audio, Video, PC disks, latest Q&As
Free 1-800-800-7555 "Guaranteed Pass"
See at http://www . worldaccessnet.com
BusinessShowcase/wpt. 4701 NE 47th St.
Vancouver, WA 98661 – WPT Publications

!!!BROADCAST EQUIPMENT!!!

We manufacture & carry Stereo FM Transmitters, RF Amplifiers, Low Pass Filters, Antennas, DJ Mixing Boards & Consoles, Mics, Compressor/Limiters, Digital Reverbs, Automation Software, RF Test Equipment, RF Parts including BGY133's, and much more! Call For Free Catalog.

Progressive Concepts
BOX 586 STREAMWOOD, IL 60107
(630)736-9822 FAX (630)736-0353

VISA MasterCard AMERICAN EXPRESS Cards

PC BOARDS

Low Cost, Precision-Made PC Boards
From Your Gerber/NC Drill Files

Put your CAD program to work for you!

PCB Milling

- Milling
- Drilling
- Routing

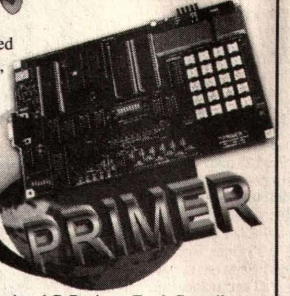
www.pcbmilling.com FAX: (703) 818-0071

SURVEILLANCE HIDDEN CAMERAS

DIRECT FROM MANUFACTURER–BEST PRICE IN THE MARKET

Ultra miniature hidden camera, in dome, smoke or motion detector w/ mic. B/W or Color. Wide view angle. Low light sensitivity + super sharp images, plus video and audio output. From $159.00. Also 1/3" B/W board Cameras w/mic, starts at $79.00 USD. Wireless hidden camera, start at only $249.00 USD. Plus $5.95 for S/H. Whole/Retail Welcome. COD, Check, Money Order or Visa/MC.

BOLIDE INTERNATIONAL CORPORATION
PH: (800) 355-0895 or (626) 575-8178
9660 Flair Drive #218, El Monte, CA 91731
http://www.bolideamazingproducts.com/



World Passing You By?

Are you interested in Microprocessors & Embedded Control Systems? If not you should be! Look around, just about everything these days has an embedded microprocessor in it. TVs, cars, radios, traffic lights & even toys have embedded computers controlling their actions. The Primer Trainer is the tool that can not only teach you how these devices operate but give you the opportunity to program these types of systems yourself. Examples & exercises in the Self Instruction manual take you from writing simple programs to controlling motors. Start out in Machine language, then move on to Assembler, & then continue on with optional C, Basic, or Forth Compilers. So don't be left behind; this is information you need to know!

Examples Include:

- **Measuring Temperature**
- **Using a Photocell to Detect Light Levels**
- **Making a Waveform Generator**
- **Constructing a Capacitance Meter**
- **Motor Speed Control Using Back EMF**
- **Interfacing and Controlling Stepper Motors**
- **Scanning Keypads and Writing to LCD/LED Displays**
- **Bus Interfacing an 8255 PPI**
- **Using the Primer as an EPROM Programmer**
- **DTMF Autodialer & Remote Controller (New!)**

The PRIMER is only $119.95 in kit form. The PRIMER Assembled & Tested is $169.95. This trainer can be used stand alone via the keypad and display or connected to a PC with the optional upgrade ($49.95). The Upgrade includes: an RS232 serial port & cable, 32K of battery backed RAM, & Assembler/Terminal software. Please add $5.00 for shipping within the U.S. Picture shown with upgrade option and optional heavy-duty keypad ($29.95) installed. Satisfaction guaranteed.

EMAC, inc.

11 EMAC WAY, CARBONDALE, IL 62901
618-529-4525 Fax 457-0110 BBS 529-5708
World Wide Web: http://www.emacinc.com

1985 - 1998
OVER
12
YEARS
OF SERVICE

CONTROL
RELAYS • LIGHTS • MOTORS

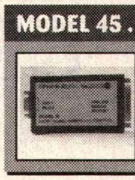
MEASURE
TEMPERATURE • PRESSURE • LIGHT LEVELS • HUMIDITY

INPUT
SWITCH POSITIONS • THERMOSTATS • LIQUID LEVELS

MODEL 30 . . . . $79

- PLUGS INTO PC BUS
- 24 LINES DIGITAL I/O
- 8 CHANNEL-
  8 BIT A/D/ IN
- 12 BIT COUNTER
- UP TO 14K SMP/SEC

MODEL 45 . . . . $189

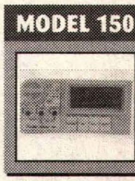


- RS-232 INTERFACE
- 8 DIGITAL I/O
- 8 ANALOG INPUTS
- 2 ANALOG OUTPUTS
- 2 COUNTERS-24 BIT

MODEL 100 . . . . $279

- 12 BIT 100 KHZ A/D
- 4 ANALOG OUTPUTS
- 3 TIMER COUNTERS
- 24 DIGITAL I/O

MODEL 150-02 . . . . $179



- RS-232 INTERFACE
- TRMS, 20 AMPS
- 12 BIT A/D
- OPTO-ISOLATED
- COMPLETE DMM

MODEL 40 . . . . $109

- RS-232 INTERFACE
- 28 LINES DIGITAL I/O
- 8 ANALOG INPUTS
- PWM OUTPUT

MODEL 70 . . . . $239

- RS-232 INTERFACE
- 18 BIT A/D
- 5.5 DIGIT
- UP TO 60 SMP/SEC

Prairie Digital, Inc.

PHONE 608-643-8599 • FAX 608-643-6754
920 SEVENTEENTH STREET • PRAIRIE DU SAC, WISCONSIN 53578

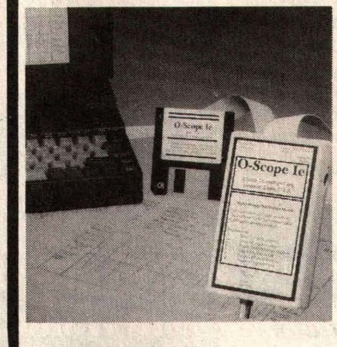
CIRCLE 315 ON FREE INFORMATION CARD

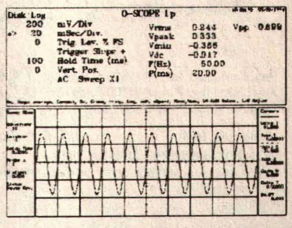
DIGITAL STORAGE
OSCILLOSCOPES

WITH
SPECTRUM ANALYZER, DVM, FREQ. COUNTER, AND DATA LOGGER.

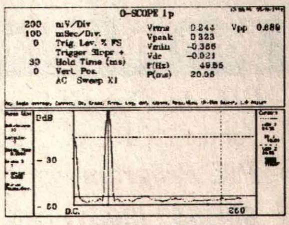
from
$189.

PORTABLE
MODULES CONVERT PC'S INTO MULTIPURPOSE TEST AND MEASURING INSTRUMENTS.





```
Disk Log                    O-SCOPE 1p
  200    mV/Div              Vrms     0.244    Vpp  0.899
   20    mSec/Div.           Vpeak    0.333
    0    Trig. Lev. % FS     Vmin    -0.386
         Trigger Slope +     Vdc     -0.017
  100    Hold Time (ms)      F(Hz)     50.00
    0    Vert. Pos.          P(ms)     20.00
         AC  Sweep X1
```



```
                            O-SCOPE 1p
  200    mV/Div              Vrms     0.244    Vpp  0.889
  100    mSec/Div.           Vpeak    0.323
    0    Trig. Lev. % FS     Vmin    -0.386
         Trigger Slope +     Vdc     -0.021
   30    Hold Time (ms)      F(Hz)     49.86
    0    Vert. Pos.          P(ms)     20.06
         AC  Sweep X1
```

Why lug a scope around? Toss one of our modules into your laptop case or tool kit. For a multi-purpose test device, plug to a PC parallel port and use the PC screen. Continuous, delayed, or triggered sweeps can be frozen on the screen, printed out, or saved to disk. Frequency Spectrums DC to 25 MHz.

Allison now provides PICO TECHNOLOGY Ltd. portable test equipment, including high-speed scopes, and multi channel data loggers. Pico and O-Scope modules accept standard probes and work with 286 or faster PC's.

FEATURES:
- PORTABLE UNITS TO 25 MHz
- USES PRINTER PORT
- USES STD. PROBES

OPTIONS:
- PROBE SETS
- AUTOMOTIVE PROBES
- BATTERY PACKS
- SOFT & HARD CASES

O-Scopes Made in U.S.A. Picos Made in U.K.
Same Day Shipping
Includes Cable, Software & Manuals

O-Scope Ip (DC-50KHz, single trace)	$189.
O-Scope II (DC-500KHz, dual trace)	$349.
PICO (ADC 200/20) (DC-10MHz, dual trace)	CALL
PICO (ADC 200/50) (DC-25MHz, dual trace)	CALL

PICO pc based data loggers from $99.
Shipping within U.S. UPS Ground $7.50 (Second day $11.50)

SEND CREDIT CARD INFO., M.O., or CHECK, OR CALL

1-800-980-9806

Allison Technology Corporation

2006 FINNEY-VALLET, ROSENBERG, TX 77471
PHONE: 281-239-8500 FAX: 281-239-8006

http://www.atcweb.com

LASER MODULE

Auto Power Control
Collimated Laser
Compact Size
100,000 hr lifetime
No Electronics Required

Visible Laser Modules(635-670 nm)
TTL Modulated Laser Modules
Line Generator Laser Modules
Infrared Laser Modules(780-830 nm)

from $ 29 (US)

LASER POINTER

Focus Adjustable
Elegant Design
Solid Metal Body

Pen Style Laser Pointer (1500 ft visibility)
Key Chain Laser Pointer (1500 ft visibility)
Available in silver and, black finish.

$19.95 (US)

World Star Tech. *Ask for free catalog*
Tel:(416)204 6298 Fax:(416)596 7619
http://www.worldstartech.com e-mail: info@worldstartech.com

PIC Programmer Kits Super Value!

Our PIC Programmer kits of parts attach to the parallel port of a PC and contain the following: PCB, parts and instructions. Uses a straight through (25 pin) cable (not supplied). **S&H: USA $4.95, Canada $7.95 Other $11.95**

P16PRO PIC Programmer
● Program all 8, 18, 28 & 40 pin PICs in the 12C5xx, 14000 and 16Cxx series (except 16C54-58). ● This kit uses the P16PRO shareware which is downloaded from the web and registered for $20. ● Visit **www.electronics123.com** for the complete list of PICs that can be programmed. ● Can program 64 pin PICs with adapter (not supplied). ● New PICs can be added.
$19.95 Code: **CPS96**

PICALL PIC Programmer: As above but can also program 16C54-58. Price includes PICALL software. (need internet for latest upgrade) Price **$79.95** Order Code: **CPS117**

PIC 16C/F84 Programmer: Software supplied on disk is for 16F84 ● **16F84-4MHz PIC included!** ●EEPROM ● Separate erase command ● Test command to check programmer & cable ● Vpp (programming voltage) is under software control ● Microchip data sheets on disk ● Software can read, verify & load (Win95/3.x/Dos)
$23.95 Code:**CPS81**

Toll Free 1-888-549-3749 (USA& Canada)
Tel (330) 549-3726. Request a FREE catalog or visit us at: www.electronics123.com for more products.
Amazon Electronics, Box 21 Columbiana OH 44408

I MB cache, AMD 350

3DNow System featuring:

Enlight Mini Tower, **VIA** chipset, 100 MHz operation, **2 USB** ports, **64 MB PC-100** compatible memory, **7.5 GB 7200 rpm** Ult DMA33 hard drive, 40X CD-Rom with audio button, **4 MB** SGRAM AGP video card, S3 Tri 3D, 1.44 floppy, **V.90/X2 PCI** faxmodem, 3D sound card, full-size speaker set, **15"** digital monitor, **Windows 98** on CD $914

tech-specialities, Inc.
(800)864-5391, fax: (713)307-0314
email: sales@ts.nu, web: www.ts.nu

Detailed Quote on other configurations (PII 300/450, single/dual CPU or **low cost**, IBM 30 MHz, 32 MB - **$699** w. monitor) by email, fax o phone. Ask for our **Free Shipping** option! Illustrated 32-page **Catalog** with latest parts, many more system options, benchmark comparisons and technical tips **free!**

www.jm-micro.com

PIC In-Circuit Emulator
for the PIC16Cxx from $295
PIC Programmer $155
80C552 (8051) Development Training System $235
68HC11 SBC $120
ROMY-16 EPROM Emulator from $195
Universal Microprocessor Simulator/Debugger (including **Assembler**, and **Disassembler**)
$100 each CPU

J&M **Microtek, Inc.**
83 Seaman Rd, W Orange, NJ 07052
Tel:(973)325-1892 Fax:(973)736-4567

Printed Circuits in Minutes Direct From LaserPrint!

8 1/2" x 11"
* Or Photocopy
**Use standard household iron or P-n-P Press.

1. LaserPrint*
2. Press On**
3. Peel Off
4. Etch

Press-n-Peel®

Use Standard Copper Clad Board
20 Shts $30/ 40 Shts $50/ 100 Shts $100
Visa/MC/PO/Ck/MO $4 S&H
Techniks Inc.
P.O. Box 463
Ringoes NJ 08551
ph. 908.788.8249 fax 908.788.8837
http:\\chelsea.ios.com\~techniks
Retail Dealer Inquires Invited

ADAPT-11
68HC11 Modules for Solderless Breadboards

- miniature 2.0" by 2.8" module
- plugs vertically into solderless breadboard for easy development
- BOOT/RUN switch for easy programming via PC serial port
- all I/O lines on dual row connector

Complete modular prototyping system!
Expansion accessories available!

For just U$74.95, our Starter Package (AD11SP) provides everything you need to get going fast! Now you can harness the power of the popular 68HC11 in your projects! Includes ADAPT-11 with 68HC811E2, providing 2K EEPROM (re-programmable), 8 channel 8-bit Analog-to-Digital Converter (ADC), hardware timers, counters, interrupts, Serial Peripheral Interface (SPI), Serial Communications Interface (SCI), & more! On-board RS-232 interface (cable included), 5-volt regulator, 8MHz crystal, reset circuit, and convenient program/run switch. Comes with non-commercial versions of 'HC11 Assembler, BASIC, & C, as well as handy utilities & example code. Includes Motorola 68HC11 Pocket Programming Reference Guide and manual with schematic. All you need is a PC to write & program your software, a DC power supply, and a solderless breadboard (or protoboard) to build your application circuits on (or use our modular accessories).

Visa • MasterCard • AmericanExpress • Discover

TECHNOLOGICAL ARTS
309 Aragona Blvd., Suite 102, Box 418, Va. Beach, VA 23462
1644 Bayview Avenue, Box 1704, Toronto, ON M4G 3C2
voice/fax:[416] 963-8996 www.interlog.com/ ~ techart

The Hack & Crack Bible
on CD-ROM

Includes all Software, Documentation, Plans, and PCB Layouts!

Unlock the secrets of:

- DSS & Smart Cards –Programming & Schematics
- Cable Test Devices
- Sony Playstation –Mod Chip/CD Backups/Emulation
- Backup Sega & SNES Console Cartridges
- Sega & SNES Emulation on your PC or Mac
- Warez – where to find them on the Internet
- Cellular Hack/Phreak/Mod
- *And Much More!*

Only $29.95

PC & Mac Compatible CD-ROM
We accept
VISA • MasterCard • AmericanExpress
To order, call Worldwyde @ 1-800-773-6698
21365 Randall Street • Farmington Hills, MI 48336
Visit us on the web at www.worldwyde.com/hack

FRIENDLY LITTLE
MICRO CONTROLLER

$149 (single)

...packs a ***MEAN*** punch
a.k.a. "Steroid Stamp"

- 39 I/O + 8 A/D (10 bit) •
- 128K SRAM + 128K Flash •
- LCD/Keypad Interface •
- Fast 16 bit Motorola CPU •
- Affordable C Compiler •
- Comprehensive s/w Library •

Intec Automation Inc. v: 250-721-5150
www.steroidmicros.com fx: 250-721-4191

10 Hr. Telephone Recorder $69+$6.95 S/H

FCC Approved

6 Hr. Tape included!

Automatically starts recording when the phone is picked up and stops when you hang up. Records both sides of the conversation!
Telephone recording controller only **$15**
3 Hour Micro Telephone recorder with tape **$49**

FREE CATALOG
www.mscelectronics.com

MSC Electronics
PO BOX 461 Jessup, MD 20794
(301) 497-1600
FAX (301) 497-1925

VISA MasterCard

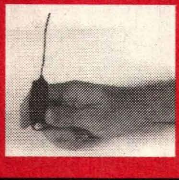
Direct from Manufacturer
We will beat any competitor's price

World's Smallest Wireless Video Camera!

- Transmits video up to 1000 ft.
- Runs on 9V battery for 12 hrs.
- Can be built into just about anything (beeper, clock, etc.)

World's smallest plug & play system about 1" x 1"

We also carry:
- Color micro video cameras
- B&W micro video cameras
- Hidden cameras
- Custom video systems
- Countersurveillance
& More



Looking for Distributors

Call for a free catalog (305) 667-4545
SECURETEK Fax (305) 667-1744
7175 SW 47 St. #205 • Miami, FL 33155

ELECTRONIC COMPONENTS

J-Tron, an electronic components distributor serving manufacturers and hobbyists.

- **Capacitors**
- **Resistors**
- **Test Meters**
- **Kits**
- **NTE Devices**

Web www.j-tron.com

Visit our website & enter our contest for a test meter.

CALL TODAY!
888-595-8766

24 Hour Fax:
973-478-8708

PIC PROJECTS
Book & CD-ROM

Many PIC Projects for Beginners & Experts!
Includes Software, Documentation, and PCB Layout

- LCDs
- X10 — Home Automation
- Keypads
- Serial Port Interface
- On-Screen Displays
- Robotics
- Data Logging
- Serial-Parallel
- And Many More!

Book & CD Only $\$24^{95}$

PIC Programmer
Programs all PIC16C55x/6x/7x/8x/9x, PIC 16F8x, and PIC12C devices. Optional ZIF adapters for SOIC & PLCC. Includes *all* necessary software.
Only $\$39^{95}$

Buy *Both* for $\$59^{95}$

We accept
VISA • MasterCard • AmericanExpress
To order, call Worldwyde @ 1-800-773-6698
21365 Randall Street • Farmington Hills, MI 48336
Visit us on the web at www.worldwyde.com/pic

Call Today And SAVE!

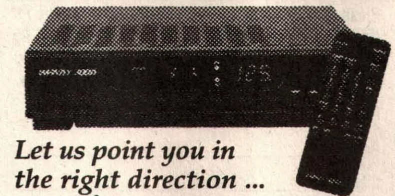
Unbeatable PRICES!

CABLE TV

DESCRAMBLERS
CONVERTERS • FILTERS
VIDEO STABILIZERS

FREE ➤ 30 Day Trial
FREE ➤ Product Catalog
FREE ➤ 1 Year Warranty

100% MONEY BACK GUARANTEE

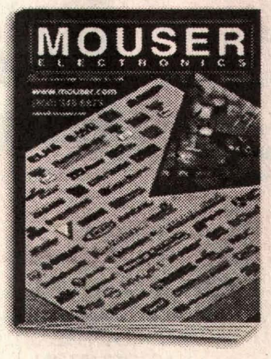


Let us point you in the right direction ...

Arrow Technologies
Omaha, Nebraska

TOLL FREE
888-554-ARROW
888-554-2776

ELECTRONIC COMPONENTS



Visit our web site!
www.mouser.com

Subscribe, download, or view catalog online!

- Over 84,000 Products
- More than 145 Suppliers
- Same Day Shipping
- No Minimum Order

800-992-9943

817-483-6828 Fax: 817-483-6899
catalog@mouser.com

958 North Main St., Mansfield, TX 76063

CIRCLE 318 ON FREE INFORMATION CARD

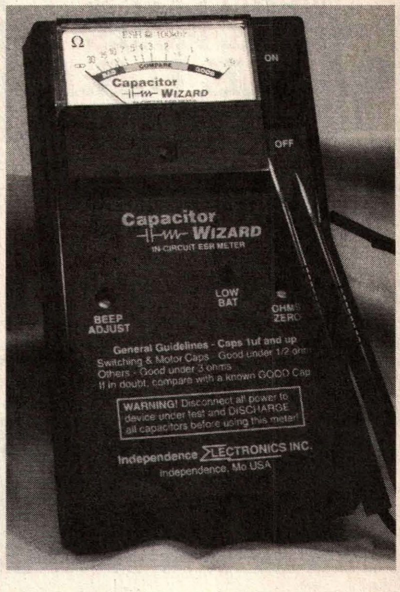
Locate Bad Caps Fast

IN-CIRCUIT!!

Lower Costly Service Time
Reduce Costly Callbacks
Tame **"TOUGH DOGS"** in Minutes

INSIST on the *ORIGINAL*
Capacitor ™ *WIZARD*
IN-CIRCUIT ESR METER

Large, easy to read analog meter makes for the fastest, most accurate testing available! Unique "Cap GOOD" beeper makes testing caps In Circuit ***virtually INSTANTANEOUS!!*** Needle sharp ***GOLD PLATED*** stainless steel probes provide FAST and POSITIVE connection to both AXIAL and RADIAL caps.



Technicians say the Capacitor Wizard is ***"the most cost effective instrument on their workbench!"***

ONLY $179.95
800-394-1984
For More Information goto
www.heinc.com/ieinc/cwinfo.htm

30 DAY MONEY BACK GUARANTEE
Order today! You Can't Lose!!!

Made in the USA!

c UL US LISTED MEASURING EQUIPMENT 20NM

Howard Electronic Instruments, Inc.
6222 N. Oliver, Kechi, KS 67067
316-744-1993 International
316-744-1994 Fax
Email: sales@heinc.com

CABLE TV EQUIPMENT

Converters, Test Cubes & Chips
Video Stabilizers

1 Year Warranty
30 Day Money Back Guarantee

"ABSOLUTE LOWEST WHOLESALE & RETAIL PRICES"

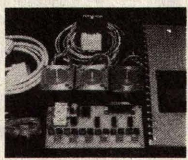
CABLE U.S.A.

1-888-388-CUBE

3 Axis Motion Control System
Complete, ready to run
$ 255.50 + 12.00 S/H

Build or adapt CNC mills, CNC routers, Robots, Etc. Includes: 3 Stepping motors (70 oz/in 200 steps/rev). External board (connects to parallel port of a PC). Power supply. Cables, Manual and the MAXNC drive software, with linear, circular and helical interpolation, acceleration deceleration, full contouring, 'G' code programming, screen plot, code generation from CAD (CAM), and more.

For more information,
phone or write to:
MAXNC
6730 West Chicago
Suites 2 & 3
Chandler, AZ 85226
Ph (602) 940-9414
Fax (602) 940-2384



SURVEILLANCE

The Latest High Tech Professional Electronic Devices

Our latest catalog offers a HUGE selection of surveillance, counter-surveillance/privacy devices: **pinhole camera** $129^00, hidden video, ***"realtime"* 12-Hour telephone recorder $139^00**, 12 hour VOX recorder phone call register, scanners, bug/phone tap detectors, voice disguisers, locksmithing tools, vehicle tracking, wireless video, and much more. Wholesale/retail.

We will not be undersold.

Catalog $5.00 *or*
www.spyoutlet.com

SPY OUTLET
PO Box 337, Buffalo NY 14226
(716) 691-3476/(716) 695-8660

MULTIMEDIA on the PC!

What is Multimedia? What can it do for you? It can do lots of nice things! This 184-page book helps you create your own multimedia presentation. Multimedia applications by people like you can revolutionize educational and business applications as well as bring more FUN, FUN, FUN into your leisure computer activities.

Mail coupon to:

Electronics Technology Today, Inc.
P.O. Box 240
Massapequa Park, NY 11762-0240

Please send me my copy of *Multiomedia on the PC* (PCP120). I enclose a check or money order for **$18.95** to cover the book's cost and shipping-and-handling expenses. NY state resident must add local sales tax.

Name ______________________

Address______________________

City ____________ State ______ Zip________

All orders must be paid in U.S. funds only. Sorry, no orders accepted outside of USA and Canada. Please allow 6-8 weeks for delivery.
MA02

Cable T.V.
Converters & Equipment

Lower Prices
Dealer Discounts
30-Day Money back
1-year warranty
MC, Visa, AE, COD

No Florida Sales

www.cable4you.com

1-(800) 888-5585

AMERICAN HEART ASSOCIATION
MEMORIALS & TRIBUTES

1-800-AHA-USA1
American Heart Association

BEST BY MAIL

Rates: Write National, Box 5, Sarasota, FL 34230

BUSINESS AT HOME

$3,000 WEEKLY! Mailing 400 brochure AT HOME! Guaranteed. FREE postage, supplies. 1-877-689-4109. Rush Self-Addressed Stamped Envelope: F.S.I., 60 East Chestnut, Suite#300-(ELE), Chicago, IL 60611.

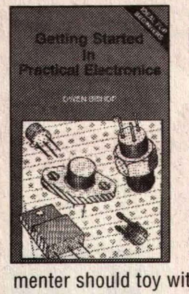
OF INTEREST TO ALL

"ANARCHIST COOKBOOK" AVAILABLE AGAIN! Complete Uncensored Edition. $25, delivered. Barricade Books, Box 1491-K, Secaucus, NJ 07096.

PERSONAL

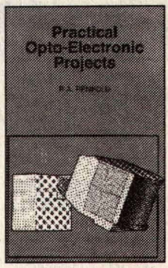
HEALTH PROBLEMS. Wealth needed. Please put Arthur in your will. Arthur F. Bothwell, P.O. Box31, Wildwood, NJ 08260. Thank you. God bless you. Jesus Christ loves you.

You can Build Gadgets!
Here are 3 reasons why!



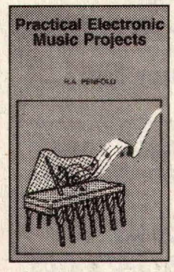
☐ **BP345—GETTING STARTED IN PRACTICAL ELECTRONICS...$6.99**

If you are looking into launching an exciting hobby activity, this text provides minimum essentials for the builder and 30 easy-to-build fun projects every experimenter should toy with. Printed-circuit board designs are included to give your project a professional appearance.



☐ **BP349—PRACTICAL OPTO-ELECTRONIC PROJECTS $6.99**

If you shun opto-electronic projects for lack of knowledge, this is the book for you. A bit of introductory theory comes first and then a number of practical projects which utilize a range of opto devices, from a filament bulb to modern infrared sensors and emitters—all are easy to build.



☐ **BP363—PRACTICAL ELECTRONIC MUSIC PROJECTS $6.99**

The text contains a goodly number of practical music projects most often requested by musicians. All the projects are relatively low-in-cost to build and all use standard, readily available components that you can buy. The project categories are guitar, general music and MIDI.

Mail to:

Electronic Technology Today, Inc.
P.O. Box 240
Massapequa Park, NY 11762-0240

Shipping Charges in USA & Canada

$0.01 to $5.00	$2.00
$5.01 to $10.00	$3.00
$10.01 to $20.00	$4.00
$20.01 to $30.00	$5.00
$30.01 to $40.00	$6.00
$40.01 to $50.00	$7.00
$50.01 and above	$8.50

Sorry, no orders accepted outside of USA and Canada. All payments must be in U.S. funds only.

☐ Number of books ordered.

Total price of books........................ $ __________
Shipping (see chart) .... $ __________
Subtotal .... $ __________
Sales Tax (NYS only)...................... $ __________
Total enclosed .... $ __________

Name ______________________

Address ______________________

City ______________ State ____ ZIP ________

Please allow 6-8 weeks for delivery.

RAMSEY

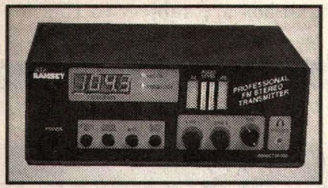
World's Smallest TV Transmitters

We call them the 'Cubes'.... Perfect video transmission from a transmitter you can hide under a quarter and only as thick as a stack of four pennies- that's a nickel in the picture!

Transmits color or B&W with fantastic quality - almost like a direct wired connection to any TV tuned to cable channel 59. Crystal controlled for no frequency drift with performance that equals law enforcement models that cost hundreds more! Basic 20 mW model transmits up to 300' while the high power 100 mW unit goes up to 1/4 mile. Audio units include sound using a sensitive built-in mike that will hear a whisper 15 feet away! Units run on 9 volts and hook-up to most any CCD camera. Any of our cameras have been tested to mate perfectly with our Cubes and work great. Fully assembled - just hook-up power and you're on the air!

C-2000, Basic Video Transmitter Cube	**$89.95**
C-3000, Basic Video and Audio Transmitter Cube	**$149.95**
C-2001, High Power Video Transmitter Cube	**$179.95**
C-3001, High Power Video and Audio Transmitter Cube	**$229.95**

Super Pro FM Stereo Radio Transmitter

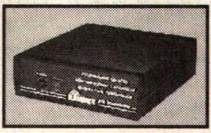


A truly professional frequency synthesized FM Stereo transmitter station in one easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features we've packed into the FM-100. Set frequency easily with the Up/Down freq buttons and the big LED digital display. Plus there's input low pass filtering that gives great sound no matter what the source (no more squeals or swishing sounds from cheap CD player inputs!) Peak limiters for maximum 'punch' in your audio - without over modulation, LED bargraph meters for easy setting of audio levels and a built-in mixer with mike and line level inputs. Churches, drive-ins, schools and colleges find the FM-100 to be the answer to their transmitting needs, you will too. No one offers all these features at this price! Kit includes cabinet, whip antenna and 120 VAC supply.

We also offer a high power export version of the FM-100 that's fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped outside the USA, or within the US if accompanied by a signed statement that the unit will be exported.

FM-100, Professional FM Stereo Transmitter Kit	**$299.95**
FM-100WT, Fully Wired High Power FM Transmitter	**$429.95**

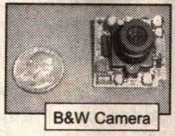
AM Band Radio Transmitter



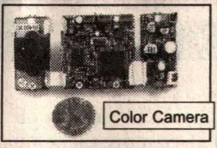
Ramsey AM radio transmitters operate in the standard AM broadcast band and are easily set to any clear channel in your area. Our AM-25, 'pro' version, fully synthesized transmitter features easy frequency setting DIP switches for stable, no-drift frequency control, while being jumper setable for higher power output where regulations allow. The entry-level AM-1 uses a tunable transmit oscillator and runs the maximum 100 milliwatts of power. No FCC license is required, expected range is up to 1/4 mile depending upon antenna and conditions. Transmitters accept standard line-level inputs from tape decks, CD players or mike mixers, and run on 12 volts DC. The Pro AM-25 comes complete with AC power adapter, matching case set and bottom loaded wire antenna. Our entry-level AM-1 has an available matching case and knob set for a finished, professional look.

AM-25, Professional AM Transmitter Kit	**$129.95**
AM-1, Entry level AM Radio Transmitter Kit	**$29.95**
CAM, Matching Case Set for AM-1	**$14.95**

CCD Video Cameras



B&W Camera

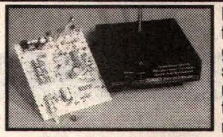


Color Camera

If you're looking for a good quality CCD board camera, stop right here! Our cameras use top quality Japanese Class 'A' CCD arrays with over 440 line line resolution, not the off-spec arrays that are found on many other cameras. You see, the Japanese suppliers grade the CCDs at manufacture and some manufacturers end up with the off-grade chips due to either cost constraints or lack of buying 'clout'. Also, a new strain of CMOS single chip cameras are entering the market, those units have about 1/2 the resolution and draw over twice the current that these cameras do - don't be fooled! Our cameras have nice clean fields and excellent light sensitivity, you'll really see the difference, and if you want to see in the dark, the black & white models are super IR (Infra-Red) sensitive. Our IR-1 Illuminator kit is invisible to the human eye, but lights the scene like a flashlight at night! Color camera has Auto White Balance, Auto Gain, Back Light Compensation and DSP! Available with Wide-angle (80º) or super slim Pin-hole style lens. They run on 9 VDC and produce standard 1 volt p-p video. Add one of our transmitter units for wireless transmission to any TV set, or add our IB-1 Interface board for audio sound pick-up and super easy direct wire hook-up connection to any Video monitor, VCR or TV with video/audio input jacks. Cameras fully assembled, including pre-wired connector.

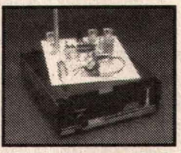
CCDWA-2, B&W CCD Camera, wide-angle lens	**$99.95**
CCDPH-2, B&W CCD Camera, slim fit pin-hole len	**$99.95**
CCDPH-2, Color CCD Camera, wide-angle lens	**$149.95**
IR-1, IR Illuminator Kit for B&W cameras	**$24.95**
IB-1, Interface Board Kit	**$24.95**

FM Stereo Radio Transmitters



Microprocessor controlled for easy frequency programming using DIP switches, no drift, your signal is rock solid all the time - just like the commercial stations. Audio quality is excellent, connect to the line output of any CD player, tape deck or mike mixer and you're on-the-air. Foreign buyers will appreciate the high power output capability of the FM-25; many Caribbean folks use a single FM-25 to cover the whole island! New, improved, clean and hum-free runs on either 12 VDC or 120 VAC. Kit comes complete with case set, whip antenna, 120 VAC power adapter - easy one evening assembly.

FM-25, Synthesized FM Stereo Transmitter Kit	**$129.95**



A lower cost alternative to our high performance transmitters. Offers great value, tunable over the 88-108 MHz FM broadcast band, plenty of power and our manual goes into great detail outlining aspects of antennas, transmitting range and the FCC rules and regulations. Connects to any cassette deck, CD player or mixer and you're on-the-air, you'll be amazed at the exceptional audio quality! Runs on internal 9V battery or external power from 5 to 15 VDC. Add our matching case and whip antenna set for a nice finished look.

FM-10A, Tunable FM Stereo Transmitter Kit	**$34.95**
CFM, Matching Case and Antenna Set	**$14.95**
AC12-5, 12 Volt DC Wall Plug Adapter	**$9.95**

RF Power Booster

Add some serious muscle to your signal, boost power up to 1 watt over a frequency range of 100 KHz to over 1000 MHz! Use as a lab amp for signal generators, plus many foreign users employ the LPA-1 to boost the power of their FM Stereo transmitters, providing radio service through an entire town. Runs on 12 VDC. For a neat, professionally finished look, add the optional matching case set.

LPA-1, Power Booster Amplifier Kit	**$39.95**
CLPA, Matching Case Set for LPA-1 Kit	**$14.95**
LPA-1WT, Fully Wired LPA-1 with Case	**$99.95**

Treasure Finder Kit

Search for buried treasure at the beach, backyard or park. This professional quality kit can detect metal at a depth of up to 6 inches. Easy to use, just listen for the change in tone as you 'sweep' the unit across the surface - the larger the tone change - the larger the object. Has built-in speaker or earphone connection, runs on standard 9 volt battery. Complete kit includes handsome case, rugged PVC handle assembly that 'breaks down' for easy transportation and shielded Faraday search coil. Easy one evening assembly. This nifty kit will literally pay for itself! That guy in the picture looks like he found something - what do you think it is - gold, silver, Rogaine, Viagra? You'll have fun with this kit.

TF-1, Treasure Finder Kit	**$39.95**

Binocular Special

We came across these nice binoculars in an importers close-out deal. Not some cheap in-line lens jobs, these beauties have roof prisms, a super nice rubber armored housing over light weight aluminum. 10 x 25 power with fully coated optics. Includes lens cleaner cloth, neck lanyard and nice carry case. For extra demanding use in bright sun, choose the EX module with ruby coated Objective lens. First quality at a close-out price! We've seen the exact same units with the 'Bushnell' name on them being sold for $30 more!

BNO-1, Binoculars and case	**$24.95**
BNO-1EX, Ruby Coated Lens Binoculars and case	**$29.95**

Speech Descrambler

Decode all that gibberish! This is the popular descrambler / scrambler that you've read about in all the Scanner and Electronic magazines. Speech inversion technology is used, which is compatible with most cordless phones and many police department systems, hook it up to your scanner speaker terminals and you're in business. Easily configured for any use: mike, line level and speaker output/inputs are provided. Also communicate in total privacy over telephone or radio, full duplex operation - scramble and unscramble at the same time. Easy to build, all complex circuitry contained in new custom ASIC chip for clear, clean audio. Runs on 9 to 15VDC. Our matching case set adds a professional look to your kit.

SS-70A, Speech Descrambler/Scrambler Kit	**$39.95**
CSS, Custom Matching Case and Knob Set	**$14.95**
SS-70AWT, Fully Wired SS-70A with Case	**$79.95**
AC12-5, 12 Volt DC Wall Plug Adapter	**$9.95**

Call for our Free Catalog !

See our complete catalog and order on-line with our secure server at:

www.ramseyelectronics.com

RAMSEY ELECTRONICS, INC.
793 Canning Parkway Victor, NY 14564

Order Toll-free: 800-446-2295

Sorry, no tech info, order status at this number

Technical Info, Order Status
Call Factory direct: 716-924-4560
Fax: 716-924-4555

VISA MasterCard DISCOVER

ORDERING INFO: Satisfaction Guaranteed. Examine for 10 days, if not pleased, return in original form for refund. Add $6.95 for shipping, handling and insurance. Orders under $20, add $3.00. NY residents add 7% sales tax. Sorry, no CODs. Foreign orders, add 20% for surface mail or use credit card and specify shipping method.

CIRCLE 266 ON FREE INFORMATION CARD

USE ELECTRONICS NOW CLASSIFIEDS

READ BY ELECTRONIC BUYERS AND SELLERS AND TRADERS

INSTRUCTIONS FOR PLACING YOUR AD!

HOW TO WRITE YOUR AD

TYPE or PRINT your classified ad copy CLEARLY (not in all capitals) using the form below. If you wish to place more than one ad, use a separate sheet for each additional one (a photo copy of this form will work as well). Place a category number in the space at the top of the order form (special categories are available). If you do not specify a category, we will place your ad under miscellaneous or whatever section we deem most appropriate.

We cannot bill for classified ads. **PAYMENT IN FULL MUST ACCOMPANY YOUR ORDER.** We do permit repeat ads or multiple ads in the same issue, but in all cases, full payment must accompany your order.

WHAT WE DO

The first word and company name of each ad are set in bold caps at no extra charge. No special positioning, centering, dots, extra space, etc. can be accommodated.

RATES

Our classified ad rate is $2.50 per word. Minimum charge is $37.50 per ad per insertion (15 words). Any words that you want set in bold are each .40 extra. Indicate bold words by underlining. Words normally written in all caps and accepted abbreviations are not charged anything additional. State abbreviations must be post office 2-letter abbreviations. A phone number is one word.

If you use a Box number you must include your permanent address and phone number for our files. ADS SUBMITTED WITHOUT THIS INFORMATION WILL NOT BE ACCEPTED.

For firms or individuals offering Commercial products or Services. **Minimum 15 Words.** 5% discount for same ad in 6 issues within one year; 10% discount for same ad in 12 issues.**Boldface (not available as all caps)**, add .40 per word additional. **Entire ad in boldface,** add 20%. **Tint screen behind entire ad**, add 25%. **Tint screen plus all boldface ad**, add 45%. **Expanded type ad,** add $4.00 per word.

General Information: A copy of your ad must be in our hands by the 13th of the fourth month preceding the date of issue (i.e. Sept issue copy must be received by May 13th). When normal closing date falls on Saturday, Sunday or Holiday, issue closes on preceding work day. Send for the classified brochure.

DEADLINES

Ads not received by our closing date will run in the next issue. For example, ads received by November 13 will appear in the March issue that is on sale January 17. ELECTRONICS NOW is published monthly. No cancellations permitted after the closing date. No copy changes can be made after we have typeset your ad. NO REFUNDS, advertising credit only. No phone orders.

CONTENT

All classified advertising in ELECTRONICS NOW is limited to electronics items only. All ads are subject to the publishers' approval. WE RESERVE THE RIGHT TO REJECT OR EDIT ALL ADS.

AD RATES: $2.50 per word. Minimum $37.50

Send you ad payments to:
ELECTRONICS NOW 500 Bi-County Blvd, Farmingdale, NY 11735-3931

CATEGORIES

100 -- Antique Electronics
130 -- Audio-Video Lasers
160 -- Business Opportunities
190 -- Cable TV
210 -- CB-Scanners
240 -- Components
270 -- Computer Equipment Wanted
300 -- Computer Hardware
330 -- Computer Software
360 -- Education
390 -- FAX
420 -- Ham Gear For Sale
450 -- Ham Gear Wanted
480 -- Miscellaneous Electronics For Sale
510 -- Miscellaneous Electronics Wanted
540 -- Music & Accessories
570 -- Plans-Kits-Schematics
600 -- Publications
630 -- Repairs-Services
660 -- Satellite Equipment
690 -- Security
710 -- Telephone
720 -- Test Equipment
730 -- Wanted

CLASSIFIED AD COPY ORDER FORM

Place this ad in Category #__________ **Special Category $30.00 Additional** ______________________

1 - $37.50	2 - $37.50	3 - $37.50	4 - $37.50	29 - $72.50	30 - $75.00	31 - $77.50	32 - $80.00
5 - $37.50	6 - $37.50	7 - $37.50	8 - $37.50	33 - $82.50	34 - $85.00	35 - $87.50	36 - $90.00
9 - $37.50	10 - $37.50	11 - $37.50	12 - $37.50	37 - $92.50	38 - $95.00	39 - $97.50	40- $100.00
13 - $37.50	14 - $37.50	15 - $37.50	16 - $40.00				
17 - $42.50	18 - $45.00	19 - $ 47.50	20 - $50.00				
21 - $52.50	22 - $55.00	23 - $57.50	24 - $60.00				
25 - $ 62.50	26 - $65.00	27 - $67.50	28 - $70.00				

Total words ________ $2.50 per word = $______
Bold Face ________ $0.40 per word = $______
Special Heading ________ $30.00 = $______
Other ________ = $______

Total classified ad payment $________ **enclosed**

TOTAL COST OF AD $ ________

[ ] Check **[ ] Mastercard** **[ ] Visa** **[ ] Discover** Card # _________________ Expiration Date __ __/__ __

Signature______________________________

Name ______________________________ Phone ______________________________

Address______________________________City State Zip ______________________________

CLASSIFIED

BUSINESS OPPORTUNITIES

Have an idea? If so, we are a national company working with ideas, inventions, new products. Patent services. Call 1-800-288-IDEA.

EASY WORK! EXCELLENT PAY! Assemble Products At Home. Call Toll Free 1-800-467-5566 Ext. 5192.

$400 Weekly Assembling electronic circuit boards/products from home. For Free information send SASE: **Home Assembly**-EN Box 216, New Britain, CT 06050-0216.

Unique Video Products Pattern Generators with character identification, composite, s-video, RGB, distribution amplifiers, kits also available. FREE catalog, **GEKCO Labs,** PO Box 642, Issaquah, WA 98027-0642, 425-888-5756, www.gekco.com

CABLE TV

Cable TV descramblers. One-piece units. Scientific Atlanta, Jerrold, Pioneer, and others. Lowest prices around. **Precision Electronics,** Houston, TX anytime.1-888-691-4610.

CABLE DESCRAMBLING, New secret manual. Build your own descramblers for cable and subscription TV. Instructions, schematics for SSAVI, Gated Sync, Sinewave, $12.95, $2 postage **CABLETRONICS,** Box 30502E, Bethesda, MD 20824.

New! Jerrold and Pioneer wireless test units $125 each, also 75DB notch filters $19.95 each, quantity pricing available please call **KEN ERNY ELECTRONICS** 24-hour order and information hot line 516-389-3536.

Cable boxes all models, all channels, lowest prices in the United States. Open seven days a week till midnite, Pacific Time. Call (877) 789-7337 Toll-Free.

Free Cable Descramblers Plans. For Details Write: Sierra Publishing, 909 E. Yorba Linda Blvd., Suite H-181, Dept. ENA, Placentia, CA 92870.

Unmodified Zeniths 5010's $17, Tocom 5507 $79, Pioneer 6310 $85, 6110 $65, 5135 $35, SA 8590 $75, 8 button replaces 8610X, Lot Prices 1-800-500-9825.

Pay TV & Satellite descrambling 1999 Edition. All the latest cable and satellite fixes $16.95. Complete Pay TV series (282 pages) $59.95. Hacking satellite systems video $29.95. Scrambling News subscription with web access $34.95. Everything listed above $99.95. Free catalog. **Scrambling News,** 4798 South Florida Ave., Lakeland, FL 33813. 941-646-2564. C.O.D.'s are O.K. Add $6.00.

CABLE TV DESCRAMBLERS. ALL MAJOR BRANDS. RFTS. HAVE MAKE AND MODEL NUMBER OF CONVERTER USED IN YOUR AREA WHEN CALLING. QUANTITY DISCOUNTS. K.D. VIDEO 1-800-327-3407.

NEW! Cellphone E.S.N. readers **$250** each, cell phone programmers **$175** each, cell phones **$25** each, DSS satellite dish card readers and programmers **$125** each, credit card readers **$250** each, Cable T.V. notch filters **50 cents** each, convertor boxes **$50** each, magnetic strip card readers for ATM machines, bank cards, drivers license, and all types of data acquisitions all under **$200** each. You pay these super low prices when you deal directly with the manufacturers. When you order "Direct Connection" a 150 page directory published by Ed Treki Publications, you will receive the largest collection of names, addresses, and phone numbers of all the leading American and International manufacturers of these products never before available. Stop paying second, third and fourth hand prices and deal directly with the source!!! Order your copy of "Direct Connection" today for **only $59.95 plus $5 shipping. All orders are sent C.O.D. Please call Ed Treki Publications 24 hour order hot line 914-544-2829.**

CABLE DESCRAMBLERS, including activators for all Jerrold Dp5-**CFT 22xx's** and **SP's.** Lowest single or lot prices. Also, **RFT-Dams** Zenith, **SCIENTIFIC ATLANTA,** and **PIONEER.** Se habla en espanol. Call 888-684-9277.

CB-SCANNERS

CB Radio Modifications! Frequencies, kits, high-performance accessories, books, plans, repairs, amps, 10-Meter conversions. The best price since 1976! Catalog $3.00. **CBCI,** Box 1898 EN, Monterey, CA 93942. www.cbcintl.com

CB Trick Books, three books 1, 2 and 3. Each book $19.95 each. Repairs, tune ups, and amplifiers. Send money order to **Medicine Man** CB PO Box 37, Clarksville, AR 72830.

COMPUTER HARDWARE

ROBOT Module. Abundant outputs, inputs, counters, compass, analog. Infinite configuration $299.00. Free catalog **WINDesign,** Box 138, Boston, NY 14025.

EDUCATION

Learn Electronics. Home Study. Outstanding Careers. Free Literature. **P.C.D.I.,** Atlanta, Georgia. Call 800-362-7070. Dept. ELF342.

PLANS-KITS-SCHEMATICS

CATALOG: Broadcasting/micro transmitters, amplifiers, antennas. **Start your own radio station books.** Audio, TV, Ham, CB, Surveillance, Science projects and more. **www.panaxis.com PAN-COM Int'l** PO Box 130-5, Paradise, CA 95967

Awesome Kits: Voice Changers, Levitators, Lasers, Solar Robots and more! Catalog $1.00. **LNS Technologies,** PO Box 67243, Scotts Valley, CA 95067 www.ncal.verio.com/~lnstech

SATELLITE EQUIPMANET

FREE Satellite TV Buyer's Guide. Best Products – Lowest Prices – Fastest Service! Dish Network, DirecTV, C/Ku-band, including 4DTV. Parts-Upgrades – Accessories! **SKYVISION** - 800-543-3025. International 218-739-5231. www.skyvision.com

DSS Hacking: How to construct and program smart cards, with pic 16C84, software, Complete DSS system schematics, $16.95. **CABLETRONICS,** Box 30502E, Bethesda, MD 20824.

Free catalog-satellite TV/GPS-DIY Technical Books, Installation Videos, Computer Analysis Software **www.baylin.com** 800-483-2423. Call toll free 1-888-416-7296.

DSS Test card. Authorizes all channels for information, plus free bonus. Call toll free 1-888-416-7296.

TEST EQUIPMENT

Large assortment of used test equipment for sale. Request catalog or visit our website. **Stevenson Equipment Company** 609-888-2846 Fax: 609-888-2847 http://www.stevensonlabs.com

POPTRONIX®

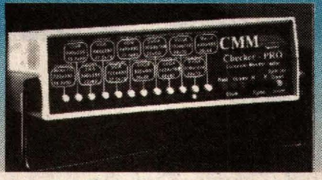
Awaiting your call! **Online Edition**

http://www.poptronix.com

CMM

Monitor/TV Test Equipment

Checker Pro



There is the Computer monitor tester you have been asking for. Sweep rates to 15-64 kHz, MGA, CGA, VGA, lots of MACs, even video (mono), GRAY SCALE, quick push button operation, "Energy Star" testing, and more. AC or Battery.

PRICE: $499.95

Checker 12e

Now you can repair and test Computer monitors with ease. With sweep rates up to 64Khz., eight step gray scale, white screen, single color mode, Mac II, EGA, CGA support, you can run almost ANY PC monitor. And it is EASY to use. Color front panel displays show just what you should see. Don't let its' small size fool you. It is the most powerful handheld available, and it supports ALL basic VGA modes (some don't). It is suitable for bench or field operations. Battery or AC operation.

PRICE:$295

Checker TV Pro & TV Jr.

The TV Pro is just the tool for your repair bench. It provides Video, S-Video, and RF outputs. It also has the most important pattern, GRAY SCALE! You can't set up a color TV without it All with NTSC standards and COMPLEX sync. The RF output also includes an audio tone and STEREO signaling With colorbars, gray scale, crosshatch with dots. you can set and test quickly.

Checker TV Pro..PRICE: $499.95

The TV Jr is a small NTSC video generator with colorbars crosshatch with dots. white. red. blue green. and black screens Small enough to fit in your pocket. powerful enough to drive the largest projection TV!

Checker TV Jr....PRICE: $129.00

Computer & Monitor Maintenance, Inc.

1-800-466-4411 • 770-662-5633

http://www.computermonitor.com

RETAILERS THAT SELL OUR MAGAZINE EVERY MONTH

Arizona

Circuit Specialists, Inc.
220 S. Country Club Dr.
Bldg 2
Mesa, AZ 85210

California

California Electronics
221 N. Johnson Ave.
El Cajon, CA 90202

Ford Electronics
8431 Commonwealth Ave
Buena Park, CA 90621

All Electronics
14928 Oxnard Street
Van Nuys, CA 91411

Mac's Electronics
191 South "E" Street
San Bernardino, CA 92401

Electronics Warehouse
2691 Main Street
Riverside, CA 92501

Orvac Electronics
1645 E Orangethorpe Ave.
Fullerton, CA 92631

Sav-On Electronics
13225 Harbor Blvd.
Garden Grove, CA 92643

JK Electronics
6395 Westminster Blvd.
Westminster, CA 92683

Kandarian Electronics
1101 19th Street
Bakersfield, CA 93301

Minute Man Electronics
37111 Post St., Suite 1
Fremont, CA 94536

HCS Electronics
6819 S. Redwood Drive
Cotati, CA 94931

Halted Specialties Co.
3500 Ryder Street
Santa Clara, CA 95051

Metro Electronics
1831 J Street
Sacramento, CA 95814

HSC Electronics
4837 Amber Lane
Sacramento, CA 95841

Colorado

Centennial Electronics
2324 E. Bijou
Colorado Sps., CO 80909

Connecticut

Cables & Connectors
2198 Berlin Turnpike
Newington, CT 06111

Electronic Service Prod.
437 Washington Avenue
North Haven, CT 06473

Georgia

Normans Electronics Inc.
3653 Clairmont Road
Chamblee, GA 30341

Illinois

Tri State Elex
200 W. Northwest Hwy.
Mt. Prospect, IL 60056

Maryland

Mark Elec. Supply Inc.
5015 Herzel Place
Beltsville, MD 20705

Massachusetts

U-Do-It Electronics
40 Franklin Street
Needham, MA 02194

Michigan

Purchase Radio Supply
327 East Hoover Avenue
Ann Arbor, MI 48104

Norwest Electronics
33760 Plymouth Rd.
Livonia, MI 48150

The Elec. Connection
37387 Ford Road
Westland, MI 48185

Minnesota

Acme Electronics
224 Washington Avenue N.
Minneapolis, MN 55401

New Jersey

Lashen Electronics Inc.
21 Broadway
Denville, NJ 07834

New York

LNL Distributing Corp.
235 Robbins Lane
Syosset, NY 11791

Unicorn Electronics
Valley Plaza
Johnson City, NY 13790

Ohio

Philcap Electronic Suppliers
275 E. Market Street
Akron, OH 44308

Oregon

Norvac Electronics
7940 SW Nimbus Avenue
Beaverton, OR 97005

Texas

Tanner Electronics
1301 W Beltine
Carrollton, TX 75006

Mouser Electronics
958 N. Main Street
Mansfield, TX 76063

Electronic Parts Outlet
3753 B Fondren
Houston, TX 77063

Computers Electronics Etc.
110 E. Medical Center Blvd.
Webster, TX 77598

If you'd like to sell our magazine in your store, please circle 210 on free information card
or
Contact Christina Estrada at (516) 293-3000 ext 223

(continued from page 45)

TABLE 3
IF70 TEST MEASUREMENTS

IC3, IC4 pin 4	–5 volts ±0.5 volts
IC2, pins 11, 14	–5 volts ±0.5 volts
IC1, pin 11	–5 volts ±0.5 volts
IC3, IC4 pin 7	+5 volts ±0.5 volts
IC3, IC4 pins 2, 3, 6	0.0 volts ±0.3 volts
IC5, pin 13	+8 volts ±0.6 volts
IC5, pin 1	+2 volts to +6 volts, varies with C29 setting
Q2, emitter	+0.7 volts to +1.0 volts
Q1, collector	+1.3 volts to +2.0 volts
Q2, collector	+8 volts ±0.6 volts
Q3, emitter	+0.3 volts to +1.0 volts
Q4, emitter	0.0 volts ±0.3 volts
IC1, IC2 pins 1, 16	–1.0 volts ±0.2 volts
IC1, IC2 pins 7, 10	–1.8 volts ±0.3 volts
IC1 pin 14 (TP1)	–4.5 volts ±0.5 volts (zero signal input)
IC2, pins 4, 5	–1.8 volts ±0.3 volts, depends on input signal

different approach due to the nature of the video signals that it is designed to demodulate: amateur TV transmissions, experimental microwave-TV signals, satellite-TV reception, and related frequency-modulated (FM) video links...that's right, FM television! Normally, only the audio portion of a television signal is frequency-modulated; the video portion of the signal relies on amplitude modulation—basic AM. The reason for that has to do with the extreme bandwidth that FM video would require. In fact, FM-based amateur television (ATV) in the 420- to 440-MHz band is not allowed for just that reason; only AM signals are able to fit within the allotted band. However, FM TV can be used to advantage in the 902- to 928-MHz band, as well as all of the higher-frequency amateur bands. In fact, all three Video IF units described in this article are designed to be connected with 440-, 900-, and 1300-MHz downconverters for the reception of ATV; the downconverter's gain can be controlled with the AGC outputs of the Video IF units.

Like AM radio, conventional television signals are susceptibile to noise under moderate or weak signal conditions; the result is "snow" in the received picture. On the other hand, having too strong of a signal can cause intermodulation-based distortions in the receiver front end; the result is a "herringbone" or patterns of wavy lines. Those interference patterns are caused by various beat frequencies and intermodulations that stem from nonlinearities in the receiver's circuits. In fact, the instantaneous transmitted power of television transmitters varies due to the nature of

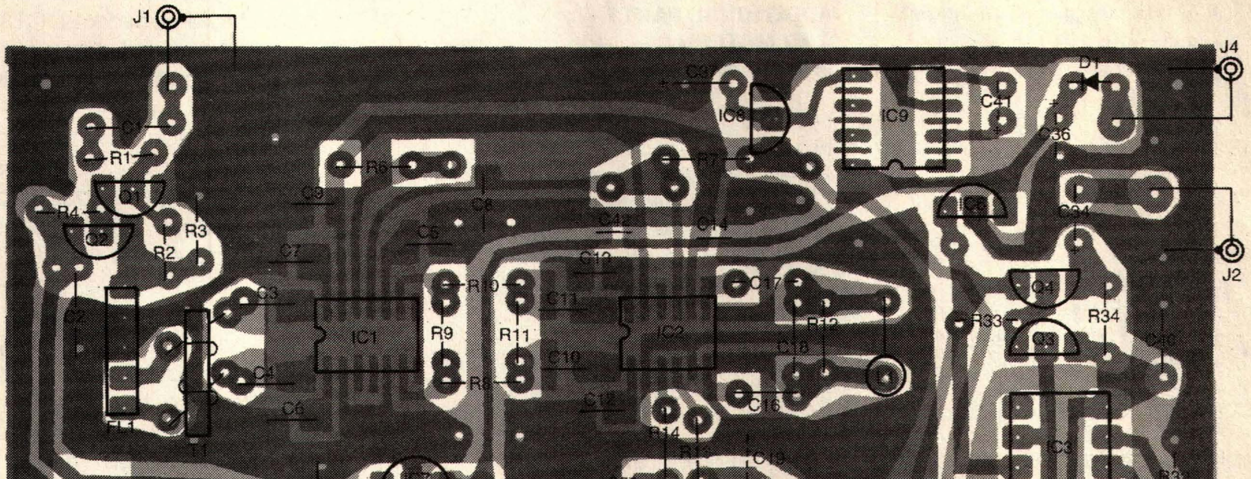


Fig. 6. The IF70 makes use of more surface-mounted components. Be careful not to cause a solder bridge when soldering IC1 or IC2 to the board—you might have to remove the chip completely in order to clear the traces underneath the component of excess solder.

PARTS LIST FOR THE 44-MHZ VIDEO IF

SEMICONDUCTORS

IC1—not used
IC2—LM1823N video IF detector, integrated circuit
IC3—MC1357 audio IF detector, integrated circuit
IC4—LMC555 timer, integrated circuit
D1—not used
D2—1N914 silicon diode
D3—1N4001 silicon diode
Q1, Q4—2N3563 NPN transistor
Q2, Q3—2N3904 NPN transistor

RESISTORS

(All resistors are ¼-watt, 5% units unless otherwise noted.)
R1—68-ohm
R2—220-ohm
R3—1500-ohm
R4—100-ohm
R5—470-ohm
R6, R29—3300-ohm
R7, R37—10,000-ohm
R8, R26—33,000-ohm
R9, R10—180-ohm
R11—18,000-ohm
R12—12,000-ohm
R13—12,000-ohm, ⅛-watt
R14—4700-ohm, ⅛-watt
R15, R17, R19—6800-ohm
R16—680-ohm, ⅛-watt
R18, R24—10,000-ohm potentiometer, PC-mount
R20—47,000-ohm, ⅛-watt
R21—2200-ohm
R22—10,000-ohm, ⅛-watt
R23, R30—10-ohm
R25—68,000-ohm
R27—330-ohm
R28—680-ohm
R31—1200-ohm
R32—330-ohm, ⅛-watt
R33—82-ohm, ⅛-watt
R34—100-ohm potentiometer, PC-mount
R35—100-ohm, ⅛-watt
R36—22,000-ohm, ⅛-watt

CAPACITORS

C1, C5—15-pF, ceramic-disc
C2, C4—33-pF, ceramic-disc
C3—6.8-pF, ceramic-disc
C6–C12—not used
C13, C14, C24—0.01-µF, ceramic-disc
C15—0.001-µF, Mylar
C16—2.2-µF, 35-WVDC, electrolytic
C17, C32—10-µF, 16-WVDC, electrolytic
C18, C19, C29, C31—0.01-mF, ceramic, surface-mount
C20, C36, C37, C40—0.1-µF, ceramic, surface-mount
C21—470-pF, ceramic-disc
C22, C25, C30—0.1-µF, Mylar
C23—0.22-µF, 35-WVDC, electrolytic
C26—100-pF, ceramic-disc
C27—39-pF, ceramic-disc
C28—47-pF, ceramic-disc
C33—3.3-pF, ceramic-disc
C34—100µF, 16-WVDC, electrolytic
C35—0.0033-µF, Mylar
C38—2–20-pF, ceramic trimmer
C39—68-pF, ceramic-disc
C41—0.47-µF, 35-WVDC, electrolytic
C42—470-µF, 6-WVDC, electrolytic
C43—47-µF, 16-WVDC, electrolytic

ADDITIONAL PARTS AND MATERIALS

FL1—44-MHz surface-acoustic-wave filter (Murata)
FL2—4.5-MHz bandpass filter (Murata)
FL3—4.5-MHz trap filter (Murata)
J1—F-style connector, panel-mount
J2, J3—RCA-style jack, panel-mount
J4—Co-axial power jack
L1–L6—22-gauge magnet wire wound on Cambion blue slugs (see text)
L7, L8—15-µH RF choke
12–14-volt DC wall-mounted transformer (RadioShack 22-504 or similar, see text), wire, hardware, etc.

amplitude-modulated video—the transmitted power changes depending on whether any particular portion of the video picture is lighter or darker.

FM television offers certain advantages over AM TV in the same way that FM radio has advantages over AM radio, including better signal-to-noise ratios, the ability to run the transmitter at a steady power output, and the "capture effect" in FM systems that tend to reject interference from weaker signals on the same frequency. However, AM does have the advantage when it comes to multipath-like interference such as "ghosting"; while annoying in an AM system, it can totally destroy FM reception because of the severe distortion of the received video. Since FM TV is used mostly at UHF and microwave frequencies, multipath distortion is all but eliminated because of the directional nature of the transmission; unless your antenna is pointing directly at the transmitter, it is difficult, if not impossible, to receive a signal.

The advantages of FM TV are put to good use in satellite broadcasts. The ability of an FM receiver to "lock" onto a weak signal is perfect for satellites; the transmitter power available in a satellite is extremely limited.

The IF70. The schematic diagram for the IF70 is shown in Fig. 3. Like the two previously-described units, the IF70 uses standard IC demodulators and surface-acoustic-wave filters to eliminate any tricky alignment and setup adjustments.

A 70-MHz input signal at J1 is applied to preamplifier stage Q1 and Q2. The gain is set by R1 and R2 to compensate for losses that occur in the SAW filter, FL1. Transformer T1 and R5 provide a balanced drive to IC1, an IF amplifier circuit that can handle FM signals as high as 300 MHz. A DC level between 0 to 3 volts appears across R6; it has a fairly logarithmic response at about one volt per 20 dB of increase in signal strength. If needed, that signal can be used as a received signal-strength indicator (RSSI).

Whereas IC1 is used as an amplifier, IC2 is set up as a limiter and quadrature detector to recover the video information. The output of IC2's limiter is coupled by C16 and C17 to quadrature network L1, C18, and R12. The recovered video-output signal, in a differential format, is available at pins 4 and 5 of IC2.

The differential video is amplified by IC4. That amplifier, configured as a differential amplifier, produces a single-ended output. The video is then de-emphasized by R21–R27, C33, and L4. The purpose of de-emphasis is to correct the frequency distortion that is deliberately introduced in the transmitted video in order to improve the signal-to-noise ratio. That method is similar to the audio pre-emphasis method that is used in FM radio.

The sound subcarrier is removed from the video signal by FL3; removing it helps reduce distortions that might be caused by a sound-to-color beat-interference.

Depending on modulation polarity, downconverter circuitry, and the effect of any frequency mixing, the output signal can have a negative or positive sync polarity. Generally, black-to-white low-to-high frequency modulation is used, but some receivers can change that. In any case, some means of polarity selection is needed. The de-emphasized video is fed to either the inverting or non-inverting input of IC3 by means of a jumper block on JP1. If you find that you need to change the video polarity frequently, JP1 can be replaced by a single-pole, double-throw switch.

The output of IC3 feeds a video buffer made from Q3 and Q4, giving the IF70 the ability to drive a 75-ohm load connected to J2.

The audio subcarrier is separated from the composite signal by FL2. The audio is then amplified, limited, and detected by a conventional quadrature-detector circuit; IC5 has been specifically designed for that purpose. The center frequency and bandwidth is set by C28, C29, L2, and R36. The adjustment of C29 sets the center frequency of the audio bandwidth. The audio output is around 0.5-volts rms into a 5000-ohm load. That amount of output drive works well with most audio gear.

Regulators IC6, IC7, and IC8 supply the +5-, +8-, and –5-volt DC levels that are needed to power the IF70. The voltage supplied to the regulators must be at least 10 volts so that IC7 has at least a 2-volt differential between its input and output pins; anything lower than that will cause the regulator to shut down. Taking the voltage drop of D1 into consideration, the supply voltage connected to J4 should be at least 11 volts; 12 volts would be ideal.

A –5-volt supply is needed for IC1 and IC2 in order to have effective RF grounding without any elaborate RF decoupling and bypassing. That voltage is also needed for op-amps IC3 and IC4. A charge-pump DC-DC converter, IC9, produces a negative voltage that is regulated by IC8. That method of obtaining a negative voltage works well because only about 35 mA is needed.

PARTS LIST FOR THE 66-MHZ VIDEO IF

SEMICONDUCTORS

IC1—SE602A video demodulator, integrated circuit
IC2—LM1823N video IF detector, integrated circuit
IC3—MC1357 audio IF detector, integrated circuit
IC4—LMC555 timer, integrated circuit
D1—MV2103 Varactor diode
D2—1N914 silicon diode
D3—1N4001 silicon diode
Q1—2N3563 NPN transistor
Q2, Q3—2N3904 NPN transistor

RESISTORS

(All resistors are ¼-watt, 5% units unless otherwise noted.)
R1, R6, R7—10,000-ohm
R2—820-ohm
R3, R21—2200-ohm
R4—100-ohm
R5—470-ohm
R8, R26—33,000-ohm
R9, R10—180-ohm
R11—18,000-ohm
R12—12,000-ohm
R13—12,000-ohm, ⅛-watt
R14—4700-ohm, ⅛-watt
R15, R17, R19—6800-ohm
R16—680-ohm, ⅛-watt
R18, R24—10,000-ohm potentiometer, PC-mount
R20—47,000-ohm, ⅛-watt
R22—10,000-ohm, ⅛-watt
R23, R30—10-ohm
R25—68,000-ohm
R27—330-ohm
R28—680-ohm
R29—3300-ohm
R31—1200-ohm
R32—330-ohm, ⅛-watt
R33—82-ohm, ⅛-watt
R34—100-ohm potentiometer, PC-mount
R35—100-ohm, ⅛-watt
R36—22,000-ohm, ⅛-watt

CAPACITORS

C1—8.2-pF, ceramic-disc
C2, C10—10-pF, ceramic-disc
C3, C33—3.3-pF, ceramic-disc
C4—15-pF, ceramic-disc
C5, C6, C11, C13, C14, C24—0.01-µF, ceramic-disc
C7—33-pF, ceramic-disc
C8—22-pF, ceramic-disc
C9—2-10-pF, trimmer
C12—1-µF, 50-WVDC, electrolytic
C15—0.001-µF, Mylar
C16—2.2-µF, 35-WVDC, electrolytic
C17, C32—10-µF, 16-WVDC, electrolytic
C18, C19, C29, C31—0.01-µF, surface-mount
C20, C36, C37, C40—0.1-µF, surface-mount
C21—470-pF, ceramic-disc
C22, C25, C30—0.1-µF, Mylar
C23—0.22-µF, 35-WVDC, electrolytic
C26—100-pF, ceramic-disc
C27—39-pF, ceramic-disc
C28—47-pF, ceramic-disc
C34—100-µF, 16-WVDC, electrolytic
C35—0.0033-µF, Mylar
C38—2-20-pF, trimmer
C39—68-pF, ceramic-disc
C41—0.47-µF, 35-WVDC, electrolytic
C42—470-µF, 6-WVDC, electrolytic
C43—47-µF, 16-WVDC, electrolytic

ADDITIONAL PARTS AND MATERIALS

FL1—44-MHz surface-acoustic-wave filter (Murata)
FL2—4.5-MHz bandpass filter (Murata)
FL3—4.5-MHz trap filter (Murata)
J1—F-style connector, panel-mount
J2, J3—RCA-style jack, panel-mount
J4—Co-axial power jack
L1–L6—22-gauge magnet wire wound on Cambion blue slug (see text)
L7, L8—15-µH RF choke
12–14-volt DC wall-mounted transformer (RadioShack 22-504 or simi-

Construction. Because of the high frequencies involved, the various Video IF units are best built on PC boards. Foil patterns for the double-sided PC boards have been included here if you wish to etch your own board. As an alternative, a pre-etched PC board is available as part of a complete kit; it is not available separately. For more information on the kits for all three units, see the Parts List for the IF70.

The boards for the three different versions of the Video IF are all the same size. If you are going to etch your own board, be sure to match up the correct pair of foil patterns—especially if you will be building the 44-MHz or 66-MHz version!

In building a board that is as tightly packed as the Video IF boards, it is helpful to first install a few larger parts such as trimmer caps and potentiometers; they will serve as landmarks. IC sockets may be used if desired, but only the low-profile type. As with any RF-based project, lead lengths should be kept as short as possible. Excess lead length and socket capacitance might cause instability and other problems such as video ringing, glitches, or oscillation; the result, of course, is poor performance.

There are also several components as well as "via" holes that must have solder connections on both sides of the board. Even if the connection is a ground, it is important to make both connections. Doing that is essential for proper RF grounding.

The parts-placement diagram for

the IF44 is shown in Fig. 4. If you are building the IF66, follow Fig. 5 instead. For the IF70, use Fig. 6. Begin by inserting all of the resistors. Note that on the IF44 and IF66, R21 is mounted vertically with the unmounted end left free. That end of R21 forms a test point; it can be formed into a small loop of wire as close to the body of the resistor as possible.

If IC sockets are to be used, install them next. When installing C9 on the IF66, be careful not to melt the plastic body when making the solder connections on the top side of the PC board. When installing the through-hole capacitors, any preformed leads should be straightened with pliers so that the component sits as close to the PC board as possible. Watch polarity of the electrolytic capacitors. DO NOT install the chip capacitors at this time; they will be mounted last.

Next, mount the transistors, diodes, and potentiometers. All of the transistors should be 1/8 inch from surface of the board. Once again, don't forget to solder any leads that have pads on both sides of the PC board. On the IF44 and IF66, D3 is installed vertically with the cathode (banded end) toward the PC board. The anode lead is formed into a terminal that will be connected to J4 later. When installing the SAW filters, double-check the orientation of the parts before soldering them.

Form the coils by winding magnet wire around a screw; Fig. 7 shows the details with Table 1 giving the number of turns needed for the various coils. Once they are made, install them where needed. Note that not all coils are used in any particular unit. On the IF70, a toroidal transformer will also be needed; its construction details are given in Fig. 8.

The surface-mount capacitors are installed on the solder side of the board; their positions are shown with a dotted line in the parts-placement diagrams. Once the surface-mount components are installed, avoid flexing the PC board; the surface-mount components might crack or become intermittent. The surface-mount ICs on the IF70 are installed on the top side of the PC board. Be very careful to avoid solder bridges between the terminals. Repairing a solder bridge on a surface-mount IC is very difficult; often, the IC must be removed to get at the underlying trace.

PARTS LIST FOR THE 70-MHZ VIDEO IF

SEMICONDUCTORS

IC1, IC2—MC13155D FM demodulator, integrated circuit
IC3, IC4—LM6362 high-speed op-amp, integrated circuit
IC5—MC1357P audio IF detector, integrated circuit
IC6—LM7805 or LM78L05 5-volt voltage regualtor, integrated circuit
IC7—LM78L08 8-volt voltage regulator, integrated circuit
IC8—LM7905 or LM79L05 –5-volt voltage regulator, integrated circuit
IC9—ICL7662 voltage converter, integrated circuit
D1—1N4007 silicon diode
Q1, Q2—2N3563 NPN transistor
Q3—2N3906 NPN transistor
Q4—2N3904 PNP transistor

RESISTORS

(All resistors are 1/8-watt, 5% units.)
R1—68-ohm
R2, R4, R9, R11, R13–R16, R32—1000-ohm
R3, R19—100-ohm
R5, R21–R26—220-ohm
R6—10,000-ohm
R7—47,000-ohm
R8, R10—680-ohm
R12—560-ohm
R17, R18, R31—4700-ohm
R20, R34—330-ohm
R27—27-ohm
R28—1800-ohm
R29—22-ohm
R30, R33—2200-ohm
R35—1200-ohm
R36—22,000-ohm

CAPACITORS

C1—100-pF, ceramic-disc
C2, C38–C40—0.01-µF, ceramic-disc
C3, C4, C8, C10, C11—470-pF, surface-mount
C5, C9, C14, C42—0.01, µF, surface-mount
C6, C7, C12, C13—100-pF, surface-mount
C15, C21, C22, C24, C37, C41—10-µF, 16-WVDC, electrolytic
C16, C17, C23, C35—2.2-pF, ceramic-disc
C18—22-pF, ceramic-disc
C19, C20—22-pF, surface-mount
C25—0.0033-µF, Mylar
C26, C30, C32—0.1-µF, Mylar
C27—3.3-pF, ceramic-disc
C28—68-pF, ceramic-disc
C29—2-20-pF trimmer
C31—0.47-µF, 35-WVDC, electrolytic
C33—0.0039-µF, ceramic-disc, 5%
C34—470-µF, 6-WVDC, electrolytic
C36—100-µF, 16-WVDC, electrolytic

ADDITIONAL PARTS AND MATERIALS

FL1—70-MHz surface-acoustic-wave filter, 11-MHz bandwidth (Siemens X6950M)
FL2—4.5-MHz ceramic bandpass filter (Murata)
FL3—4.5-MHz ceramic trap filter (Murata)
JP1—3-pin header, 0.1-inch center spacing
L1—22-gauge magnet wire wound on Cambion blue slug (see text)
L2, L3—15-µH RF choke
L4—470-µH RF choke
T1—Toroid transformer (see text)
12–14-volt DC wall-mounted transformer (RadioShack 22-504 or similar, see text), jumper block, wire, hardware, etc.

Note: A complete kits of all board-mounted components and a drilled and etched PC boardare available from North Country Radio, PO Box 53, Wykagyl Station, New Rochelle, N.Y. 10804-0053; Web: http://www.northcountryradio.com: IF44, $54.75; IF66, $ 59.75; IF70, $ 69.75. Please include $4.50 for shipping and handling within the US, or $10.00 for shipments outside of the US. NY residents must add appropriate sales tax. Please note that cases, switches, power supplies, or external connectors are not

Install a short lengths of stiff wire with a loop at the end at TP6; if you do the same for the IF-input, audio-output, and video-output terminals, it will make wiring the PC board into the case easier. Install the through-hole ICs in the board by either inserting them into the sockets or soldering them directly to the board. Keep in mind that the ICs are static sensitive.

Carefully inspect your work for solder shorts, poor joints, missing parts, incorrect parts placement, and improper orientation of polarized parts such as ICs, filters, transistors, and electrolytic capacitors. Once you are satisfied with your work, the Video IF can be mounted in a suitable metal or plastic case with input, output, and power connectors of your choice. A metal box is preferred since it provides shielding and reduces noise pickup. Recommended connectors for the Video IF are F or BNC connectors for J1, RCA connectors for J2 and J3, and a co-axial power jack for J4; the choice for J4 will depend on your available power supply.

As the circuitry uses about 2 to 3 watts of DC power, it will run somewhat warm and should be ventilated if it will be used in a small space. The Video IF works best with a high-quality wall-mounted 12-volt power supply that is capable of at least 200 mA. You should avoid using inexpensive units as they are often poorly filtered and unregulated; they can blow out the ICs due to overvoltage.

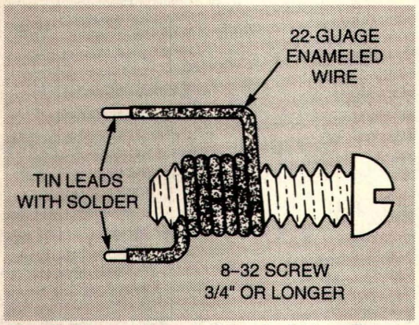


Fig. 7. The coils needed by the Video IF units are easy to make when a machine screw is used as a winding form.

When everything is assembled, you are ready to test the unit.

Testing the IF66. Testing and calibrating the IF66 is straightforward and only requires simple test equipment: a digital voltmeter, a source of NTSC television signal on Channel 3 or 4 (such as the output of a VCR), and an NTSC video monitor to view the output. A computer monitor will not work unless it can display NTSC composite video. Many newer TV sets have an external video-input jack; such a set will work well. Of course, appropriate cables are also needed to connect the equipment together.

A frequency counter that is reliable to at least 200 MHz is a great help in setting up the local oscillator, although an FM-broadcast receiver covering the 88- to 108-MHz band can serve if a frequency counter is unavailable.

To begin, connect the power supply to J4. Note that D3 will prevent any damage if the power supply polarity is accidentally reversed. Measure the current being drawn by the unit; it should be around 150 to 200 mA. If it is higher, check for possible shorts. If it is lower than 150 mA, something might be open or missing from the circuit. Make sure that all of the connections to the top side of the board—especially connections to the power-supply traces—have been installed.

Referring to the schematic diagram and the parts-placement diagram, check for the voltages listed in Table 2 with respect to ground.

Note that nothing should be getting hot. Although IC2 will run somewhat warm, it should not be uncomfortable to hold your finger on it. Any major variations from the expected readings should be investigated before proceeding. Check for parts placement, component values, solder shorts, and poor joints. Make sure that your test equipment is set up properly.

Set R18, R24, and R34 to the center of their rotation range, C9 and C38 so that their plates are ¼ meshed, and the slugs in all of the coils so that they are flush with the top of their windings. Back the slugs in L4, L5, and L6 out 2½ turns; they should be 1/16 to 3/32 inch above the top of the windings.

Turn the unit off. Connect the outputs at J2 and J3 to a monitor and audio amplifier, respectively, and J1 to a video source. Temporarily connect a clip lead between TP1 (the free end of R21) and ground. With the signal source, monitor, and audio turned on, power up the Video IF. You should see at least some noise or other indication that the Video IF is working. Some audio activity should also be heard, if only an increase in noise. If not, check all connections.

Couple a frequency counter to L3 using a 2- or 3-turn loop of wire. Rotate C9 to obtain a reading of 107 MHz (for Channel 3) or 113 MHz

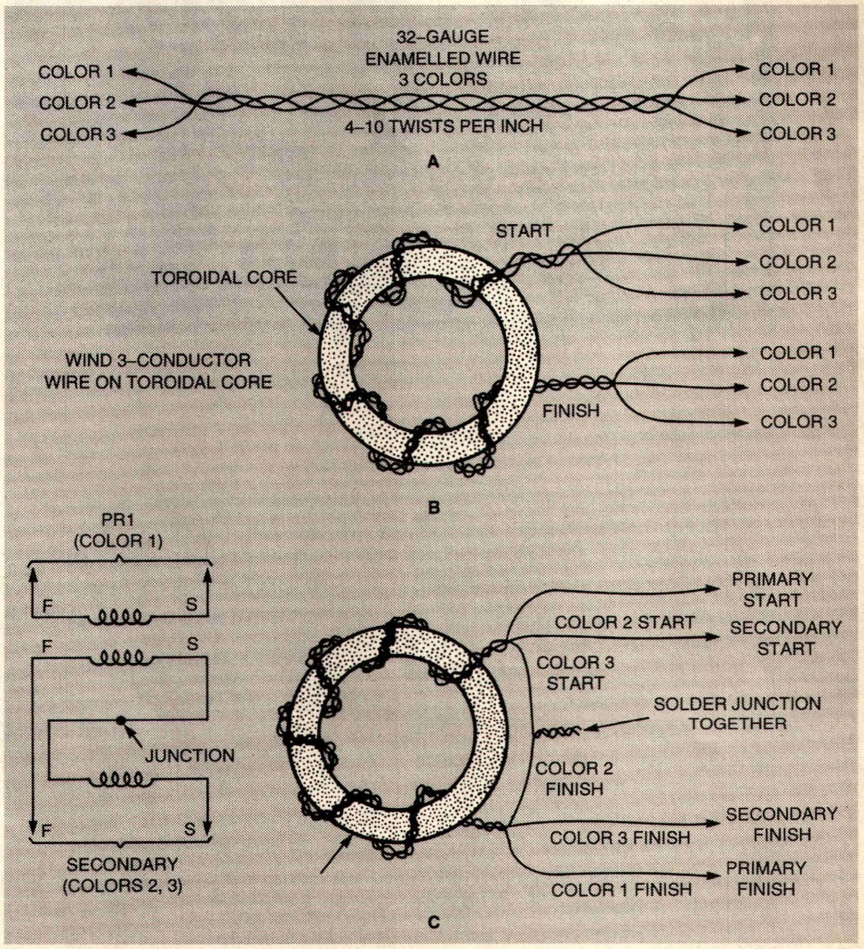
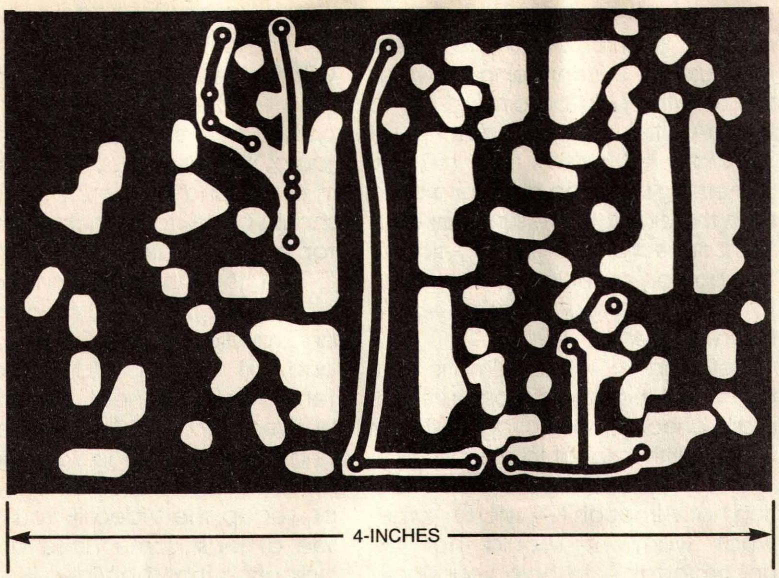
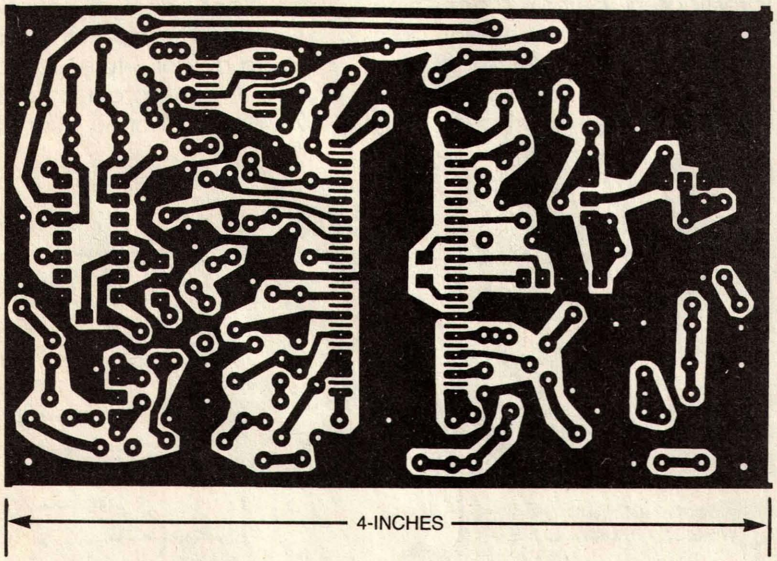


Fig. 8. Although the transformer for the IF70 is a bit more complicated to make, it is still easy to do by following these simple steps.



Here is the foil pattern for the component side of the IF44.



Here is the foil pattern for the solder side of the IF44.

(for Channel 4). Readings within 200 kHz of those frequencies are OK; they should be steady. Any reading that is jumping wildly or way off indicates a problem with the circuit. An FM receiver tuned to a quiet spot near 106 MHz can be used if no counter is available or if a reliable counter reading cannot be obtained. Listen for the local-oscillator signal as C9 is rotated. It will sound like a sudden quieting of background noise as C9 is tuned through the receiver frequency.

Connect a voltmeter between pin 18 of IC2 and ground. Adjust the slug of L6 until a video image appears on the monitor. Once a picture is available, set L6 for a 4.5-volt reading. Connect the meter to TP4 (wiper of R24). Adjust for a reading of about 4.5 to 5 volts. Adjust R34 for the best picture quality on the monitor.

Remove the clip lead from TP1 (free end of R21). The picture may become garbled—that is OK. Connect the voltmeter to TP2 (the junction of R1, R6, and C14). Adjust the slug in L4 to bring back the picture on the monitor. The best picture quality should occur at around a 3-volt reading. That adjustment will be somewhat "sharp." You may have to retouch C9 so that the best picture is obtained at a reading of 3 to 3.5 volts at TP2. That is the AFT adjustment.

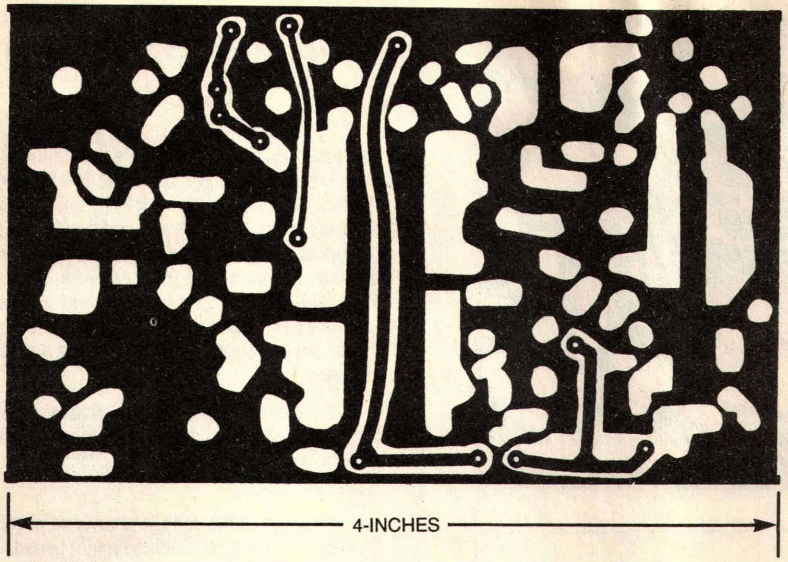
Adjust C38 for the clearest audio. If you run out of adjustment range or find that C38 is fully meshed or unmeshed at the best audio setting, change C39 to 82 pF or 56 pF, respectively. That will likely be unnecessary in most cases. Before doing that, check that the value of C33 is correct (3.3 pF, not 33 pF), L7 has continuity, and that C40 is properly installed. If there is still no audio, check that FL1 and FL2 have not been mixed up by accident and that IC3 and its associated components are correctly installed.

Try adjusting L5 for the maximum RF voltage at pin 25 of IC2. If you don't have the equipment to do that, simply experiment with the settings of L5 for the best appearing picture. That adjustment is somewhat broad; if it seems to have little effect, simply return the slug to its initial preset position (backed out 2.5 turns from flush with top).

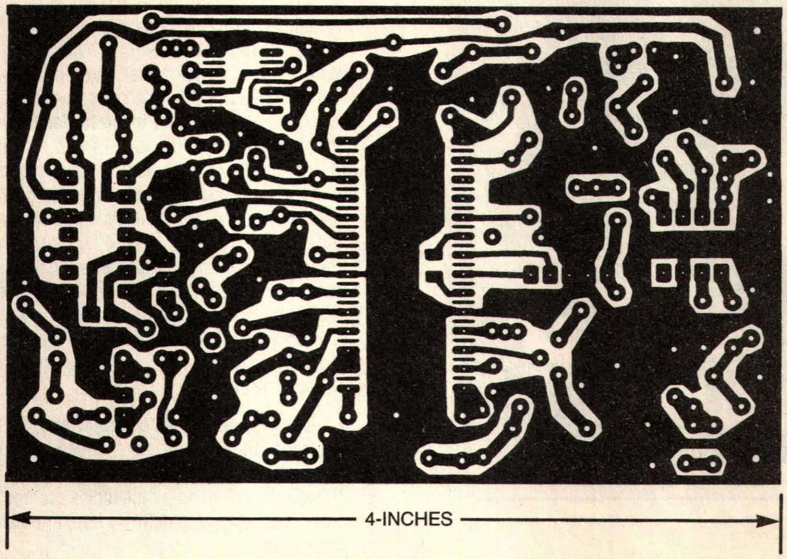
Adjust L1 and L2 for a frequency response that is within 2 dB over the range of 60–72 MHz. If no suitable test equipment is available, try adjusting the slugs for the best picture. Do not exceed 2 turns in either direction from the initial settings. If little or no improvement can be seen, return the slugs to the initial settings.

The IF66 is now considered calibrated and working. As an additional test, vary the supply voltage from 11.5 to 14.4 volts. Under no circumstances should the supply voltage exceed 14.4 volts. The Video IF should work over that range. If it does not, recheck all of the settings and readjust as needed. Sometimes you might find that L6 will have to be reset slightly.

With a slight modification, the IF66 can be adjusted to operate on Channel 2. Simply add a turn to L1, L2, and L3. The local-oscillator frequency will then be 101 MHz. If you'd like to raise the output to Channel 5 or 6, remove a turn from those coils. The local-oscillator frequency would then become 119 MHz for channel 5 and 129 MHz for channel 6. No changes would need to be made to L4, L5, or L6; the alignment procedure would be the same except for the different LO frequencies.



Here is the foil pattern for the component side of the IF66.



Here is the foil pattern for the solder side of the IF66.

Testing the IF44. The IF44 will use the same test setup as the IF66 with the exception of the input signal. Some source of 44-MHz IF signal will be needed. That type of signal can be obtained from a surplus TV tuner taken from a junked TV set. A TV-signal generator can also be used if one is available. Since the IF44 has no local oscillator, no frequency counter or FM radio is needed.

With those differences in mind, the testing procedure for the IF66 can be used with the IF44 except for tests having to do with the IF66's local oscillator; those components are not a part of the IF44.

Note that when the test clip is removed from R21, the picture should not become garbled; L4 should be adjusted for a 3.5-volt reading on TP2. When adjusting L1 and L2, the target frequencies are 40–47 MHz.

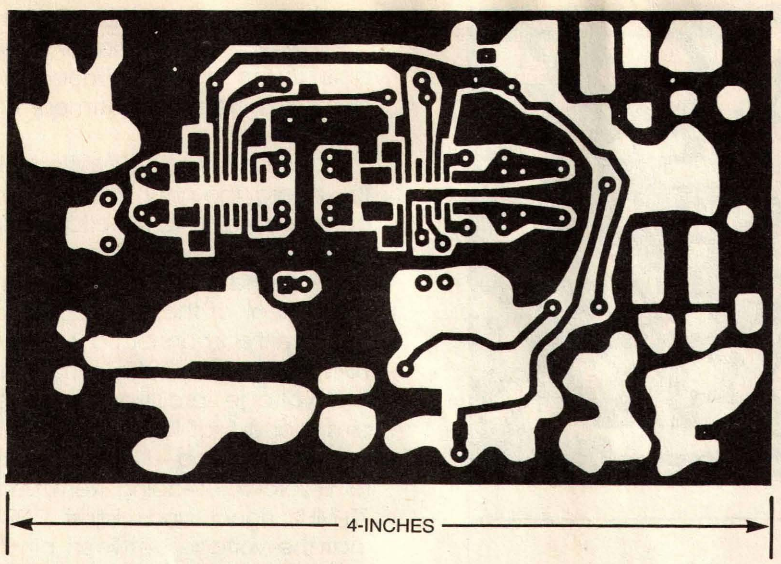
Testing the IF70. The IF70 needs very little setup and should work well enough to see a video image and hear some audio even with no alignment. A digital voltmeter and a source of 70-MHz signal are needed. If no FM video is available, a simple carrier-wave signal will do. Conventionsal AM video (such as from VCRs) will not work. By using an unmodulated carrier, the settings will be close enough so that when an actual FM-video signal is available, the most that will need to be done is a slight readjustment of L1 and C29.

Apply a source of 12-volt power to the board. The chart in Table 3 indicates where to take voltage measurements, as well as the expected reading and its tolerance.

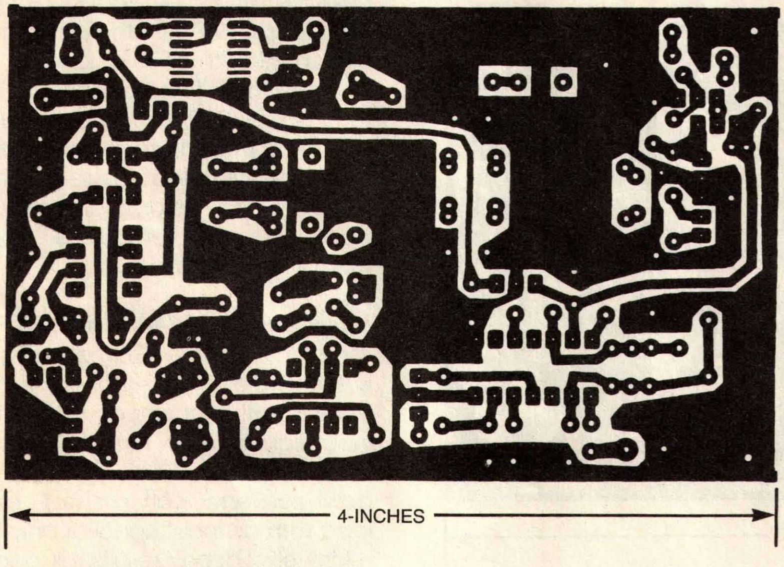
Once all of those voltages have been verified, connect a 2 to 10 mV 70-MHz signal to J1. While monitoring the voltage produced between pins 4 and 5 of IC2 (will usually be between +1 and −1 volts), adjust L1 for a zero-volt reading. Remove the 70-MHz signal and adjust C29 so that the voltage between pin 1 of IC5 and ground is halfway between the maximum and minimum voltages that can be produced while adjusting C29. With that, the initial alignment of the IF70 is done.

When the IF70 is installed in a system, adjust C29 for the best audio (as heard through speakers) and L1 for the best video (as seen on a monitor). The initial alignment will be found to be pretty close to optimum in many cases.

Interfacing the IF44 and IF66. The use of AGC on the RF amplifier stage is strongly advised when using the Video IF with a downconverter. While input signals up to 10 mV or so can be handled, a 30-dB gain on the downconverter can cause IF overload with an input signal of only 300 microvolts. For best results, it is recommended that the AGC output from TP6 be connected to the gain-control input of the downconverter. A capacitor between 10 and 100 µF should also be connected between the AGC signal and ground. That will provide filtering and a time constant. Failure to do that will result in picture breakup on strong signals; horizontal "pie crusting"; horizontal lines; and an otherwise very noisy, poor-quality picture. It is best to experiment with the capacitor value for best results in a particular situation. The capacitor should ideally be non-polarized, as AGC voltages can vary from +1 volt at maximum gain down to −3 volts. In practice, most good quality aluminum electrolytic capacitors of the polarized type will function up to somewhat more than



Here is the foil pattern for the component side of the IF70.



Here is the foil pattern for the solder side of the IF70.

1 volt of reverse voltage without damage. In that case, make sure that the POSITIVE lead is connected to ground. If you are uncomfortable with that approach, use a non-polarized unit, a Mylar device, or create a non-polarized device by wiring two polarized units back to back in series. Downconverters of various manufacture might need additional modifications that depend on circuitry. That is beyond the scope of this article; it is left to the experimenter.

You should adjust R18 so that the AGC voltage starts to fall from +1 volt toward the negative levels when a signal of about 5 to 10 mV is present at the IF input. That will let the downconverter run at full gain at up to 100-300 microvolts.

The Video IF has been designed to interface with downconverters that have appeared in past issues of **Electronics Now**, including the May-June 1996 and September 1992 issues.

With the various versions of the Video IF, you can work with just about any type of video signal available today. As you experiment with them, new uses will suggest themselves as you become familiar with their capabilities. Ω

Take Stock in America U.S. SAVINGS BONDS

TIPS FOR MAIL ORDER PURCHASE

It is impossible for us to verify the claims of advertisers, including but not limited to product availability, credibility, reliability and existence of warranties. The following information is provided as a service for your protection. It is not intended to constitute legal advice and readers are advised to obtain independent advice on how to best protect their own interests based upon their individual circumstances and jurisdictions.

1. **Confirm price and merchandise information** with the seller, including brand, model, color or finish, accessories and rebates included in the price.

2. **Understand the seller's return and/or refund policy**, including the allowable return period, who pays the postage for returned merchandise and whether there is any "restocking" or "return" charge.

3. **Understand the product's warranty**. Is there a manufacturer's warranty, and if so, is it for a U.S. or foreign manufacturer? Note that many manufacturers assert that, even if the product comes with a U.S. manufacturer's warranty, if you purchase from an unauthorized dealer, you are not covered by the manufacturer's warranty. If in doubt, contact the manufacturer directly. In addition to, or instead of the manufacturer's warranty, the seller may offer its own warranty. In either case, what is covered by warranty, how long is the warranty period, where will the product be serviced, is there a charge for service, what do you have to do to obtain service and will the product be repaired or replaced? You may want to receive a copy of the written warranty before placing your order.

4. **Keep a copy of all transactions**, including but not limited to cancelled check, receipt and correspondence. For phone orders, make a note of the order including merchandise ordered, price, order date, expected delivery date and salesperson's name.

5. **If the merchandise is not shipped within the promised time,** or if no time was promised, within 30 days of receipt of the order, you generally have the right to cancel the order and get a refund.

6. **Merchandise substitution** without your express prior consent is generally not allowed.

7. **If you have a problem with your order or the merchandise,** write a letter to the seller with all the pertinent information and keep a copy.

8. **If you are unable to obtain satisfaction from the seller**, contact the consumer protection agency in the seller's state and your local Post Office.

If, after following the guidelines, you experience a problem with a mail order advertiser that you are unable to resolve, please let us know. Write to Advertising Department, Gernsback Publications Inc., 500B Bi-County Blvd. Farmingdale, NY 11735.

Be sure to include copies of all correspondence.

BY DON LANCASTER

Pulse Radio, Brain Parity, Richard Feynman, and More

WHAT WILL BE THE "NEXT BIG THING" FOLLOWING SPREAD-SPECTRUM COMMUNICATIONS? MY BEST GUESS IS THAT IT JUST MIGHT INVOLVE MUCH OF THE INCREDIBLE NEW STUFF COMING DOWN IN AN EXPLODING FIELD KNOWN AS...

Pulse Radio

We have seen a number of times before how important it is to relate time and frequency in nearly all of advanced electronics. Seems there was this Fourier dude who said that any time or pulse waveform can be made up from bunches of carefully selected sinewaves correctly added together. For instance, a repeating squarewave can be built by taking a sine plus a third of its third harmonic, plus one fifth of its fifth harmonic, and so on. You can see more of this in MUSE90.PDF on my Web site (www.tinaja.com).

Let us try this again in Fig. 1, only this time I'm going to take ten sinewave harmonics and carefully weigh each harmonic to stronger than usual values. I'll then add them together. We get a fairly nice narrow pulse as an output. The PostScript code that lets you explore this by yourself appears in MUSE135.PSL on my Web site.

What happens here is that all the sinewaves "pile up" or time correlate on their pulse peak but pretty much cancel out otherwise.

Yes, this pattern repeats. There are lots of other pulses "hidden" off the graph. But we could keep adding lower and lower frequency sinewaves to spread the repetitions further and further out in time. And, yes, the pulse baseline should be shifted on down from zero because the positive energy of a pile of sinewaves has to equal their negative energy on a long-term average. But we can again get rid of most of this shifting by adding enough subharmonics. Thus, a single pulse can be built from a large enough pile of carefully arranged sinewaves.

This is a very simple example of a spread-spectrum scheme. Note that energy is transmitted simultaneously at ten different frequencies to build the pulse. Similarly, if we have this pulse, its energy will be spread out over ten different frequencies.

You could think of this pulse as having ten separate transmitters, each on its own frequency channel. Should there be any multipath or interference problems on a channel or two, all the others should fill in as needed to give you reliable communications.

Figure 2 shows us a very useful single shape known as a Gaussian pulse. Instead of being built up from a few locked harmonics, a Gaussian pulse has energy components of all possible frequencies. As you can see, a 1-nanosecond pulse width uses frequencies that mostly lie below 1 gigahertz. One nanosecond is a nice size, since it also equals one foot of radar resolution.

Very nicely, a Gaussian pulse can be produced in an antenna and then transmitted by suddenly changing an antenna's current in a step-like manner. We see that Gaussian pulses have an extremely spread spectrum. Now, if we can find some way to suddenly switch amp-sized or larger signals into a special antenna and if we can find some way to build up physically small ultra-broadband antennas with decent low-frequency radiation resistance, and if we can find some elegant means to move repeating pulses around, then all sorts of exciting things happen.

And that is pretty much what pulse radio is all about.

Using pulse radio, you send out a bunch of Gaussian pulses that repeat in

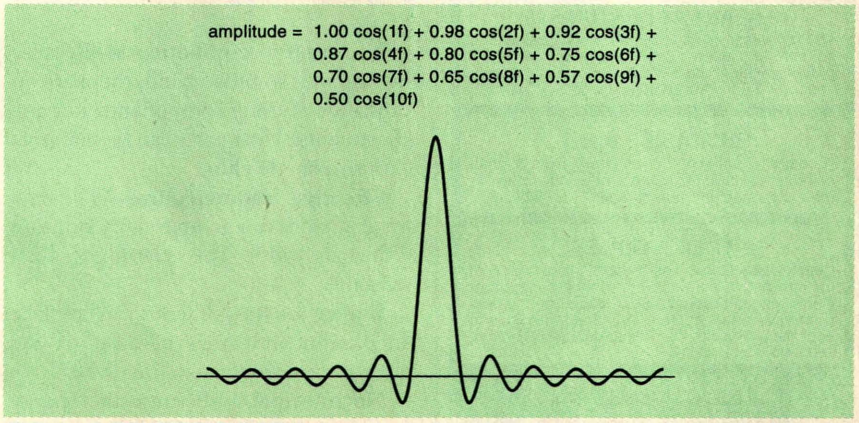


FIG. 1—A FOURIER PULSE that can be built up from ten sinewave harmonics by using the amplitudes and phasing shown.

new from
DON LANCASTER

ACTIVE FILTER COOKBOOK
The sixteenth (!) printing of Don's bible on analog op-amp lowpass, bandpass, and highpass active filters. De-mystified instant designs. **$28.50**

RESEARCH INFOPACKS
Don's instant cash-and-carry flat rate consulting service. Ask any reasonable technical question for a detailed analysis and complete report. See www.tinaja.com/info01 for specifics. **$79.00**

CMOS AND TTL COOKBOOKS
Millions of copies in print worldwide. **THE** two books for digital integrated circuit fundamentals. About as hands-on as you can get. **$28.50** each.

INCREDIBLE SECRET MONEY MACHINE II
Updated 2nd edition of Don's classic on setting up your own technical or craft venture. **$18.50**

LANCASTER CLASSICS LIBRARY
Don's best early stuff at a bargain price. Includes the CMOS Cookbook, The TTL Cookbook, Active Filter Cookbook, PostScript video, Case Against Patents, Incredible Secret Money Machine II, and Hardware Hacker II reprints. **$119.50**

LOTS OF OTHER GOODIES

Tech Musings V or VI	$24.50
Ask the Guru I or II or III	$24.50
Hardware Hacker II, III or IV	$24.50
Micro Cookbook I	$19.50
PostScript Beginner Stuff	$29.50
PostScript Show and Tell	$29.50
PostScript Video & secrets	$29.50
PostScript Reference II	$34.50
PostScript Tutorial/Cookbook	$22.50
PostScript by Example	$32.50
Understanding PS Programming	$29.50
PostScript: A Visual Approach	$22.50
PostScript Program Design	$24.50
Thinking in PostScript	$22.50
LaserWriter Reference	$19.50
Type 1 Font Format	$16.50
Acrobat Reference	$24.50
Whole works (all PostScript)	$380.00
Technical Insider Secrets	FREE

BOOK-ON-DEMAND PUB KIT
Ongoing details on Book-on-demand publishing, a new method of producing books only when and as ordered. Reprints, sources, samples. **$39.50**

THE CASE AGAINST PATENTS
For most individuals, patents are virtually certain to result in a net loss of sanity, energy, time, and money. This reprint set shows you Don's tested and proven real-world alternatives. **28.50**

BLATANT OPPORTUNIST I
The reprints from all Don's Midnight Engineering columns. Includes a broad range of real world, proven coverage on small scale technical startup ventures. Stuff you can use right now. **$24.50**

RESOURCE BIN I
A complete collection of all Don's Nuts & Volts columns to date, including a new index and his master names and numbers list. **$24.50**

FREE SAMPLES
Check Don's Guru's Lair at *http://www.tinaja.com* for interactive catalogs and online samples of Don's unique products. Searchable reprints and reference resouces, too. Tech help, hot links to cool sites, consultants. email: *don@tinaja.com*
FREE US VOICE HELPLINE VISA/MC

SYNERGETICS
Box 809-EN
Thatcher, AZ 85552
(520) 428-4073

FREE catalog: http://www.tinaja.com

NAMES & NUMBERS

Adobe Systems
PO Box 7900
Mountain View, CA 94039
(800) 833-6687

Allegro Micro Systems
Box 15036
Worcester, MA 01605
(508) 853-5000

Analog Devices
PO Box 9106
Norwood MA 02062
(800) 262-5643

Brand Dielectrics
50 Brigham St.
Marlborough, MA 01752
(508) 303-8900

Electronics Cooling
1600 Osgood St., Room 21-3D-39
North Andover, MA 01845
(508) 960-6443

Inside Finishing
PO Box 12090
Portland, OR 97212
(503) 331-6221

International Rectifier
233 Kansas St.
El Segundo, CA 90245
(310) 322-3331

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035
(408) 432-1900

MEMSCAP
50, allee des Dauphins
ZAC du Pont Rivet
38330 St Ismier, France

Novicki, Chet/Gigabooks
PO Box 90674
Honolulu, HI 96835
chet@gigabooks.net

Paper Plus
4101 McEwen #800
San Antonio, TX 75244
(888) PAPERPLUS

Plastikoil
Northgate Dr
Warrendale, PA 15086
(800) 665-7884

Smart Card Alert
300 S Wacker Dr., Suite 1800
Chicago, IL 60606
(312) 913-1334

Society Amateur Scientists
4735 Clairemont Dr. #179
San Diego, CA 92101
(800) 873-8767

Synergetics
Box 809
Thatcher, AZ 85552
(520) 428-4073

Texas Instruments
PO Box 655303
Dallas, TX 75380
(800) 336-5236

Unibind/Pelsaer
4125 Prospect Dr.
Carmichael, CA 95608
(916) 967-6401

Vision Systems Design
98 Spit Brook Road
Nashua, NH 03062
(603) 891-0123

a usefully coded sequence. Either to communicate by sending out digitized info or to radar measure a distance by evaluating path times.

All of that just might give us several really big advantages:

No tuning components—Because the system is so broad band, there are no resonant or tuning components, nor any adjustments. Most parts can be integrated onto a single chip.

Effective frequency use—The data or signal rates can go up to 70% or more of the bandwidth. This is far higher than normal.

Lower costs—Silicon can replace fancy semiconductors because of the lower system frequencies involved.

No multipath—Because the energy is splattered across the entire spectrum, multipath signal problems virtually disappear.

Better penetration—Pulse radio does seem remarkably adept at going into buildings, through trees, and even can do limited ground penetration.

Highly secure—It seems exceptionally difficult for a third party to intercept pulse-radio communications when they do not know the spreading codes.

Interference resistant—Jamming an ultra-broad-band signal is very hard to do if you are using anything this side of a raw spark gap.

High resolution—Distances can now be measured to surprising accuracy for a given cost and bandwidth. Very precise clocks are not needed.

High channel capacity—Hundreds or even thousands of users can share the same region interference free, when codes are properly selected.

Long range—Communications up to several miles are possible at milliwatt power levels.

Micropower—Most transmitters and receivers should need far less power. Besides being smaller and cheaper than conventional circuits.

Actually, pairs of pulses known as impulse doublets or monocycles are usually transmitted by connecting an "H" bridge to a broad-band current-mode antenna. A logic one is sent with a positive pulse first; a logic zero is sent with negative polarity first. The positioning of the individual pulses sets up an elaborate pseudorandom code with strong self-correlation and very low cross-correlation properties. Different codes let hundreds or even thousands of transmissions in any area that do not interfere.

A simplified block diagram of one possible pulse radio setup appears in Fig. 3. The transmitter is just an H-Bridge driver, usually built up from CMOS. Suddenly flip switches a and d, and a positive Gaussian pulse is output from the current-mode antenna. When you turn b and c on, a negative Gaussian pulse is output. Between pulses, the antenna current is given a return path by turning on switches a and b or switches c and d.

The receiver consists of an antenna and a broad-band amplifier. A local phase-locked loop or a similar circuit keeps track of the expected arriving ones and zeros. An attempt is made to match what you really get against what is expected using a correlation technique. Finally, the received data either is passed on as data (for a modem) or is converted to a distance measurement (for a radar). More on correlation can be found in HACK54.PDF.

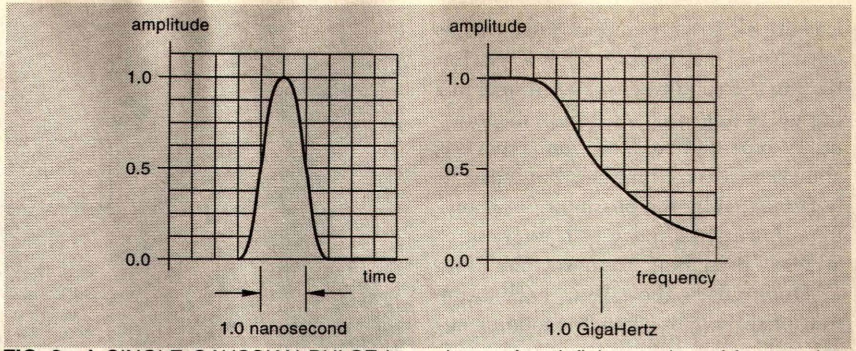


FIG. 2—A SINGLE GAUSSIAN PULSE is made up of an infinite number of frequencies. Most of the energy in a 1 nanosecond Gaussian pulse lies in frequencies that are below 1 gigahertz.

If you are interested in learning more about pulse radio, some resource Web sites and papers are shown in Fig. 4. To search on your own, the simplest starting point is to just punch "impulse radar" into Hotbot. Use the button at www.tinaja.com. Next check the Ultralab link farm (commsci.usc.edu/ulab/links.html). The leading advocacy group is the Ultra Wide Band Working Group (www. uwborg). Good link lists appear there and www.time.domain.com.

NEED HELP?

Phone or write all your US Tech Musings questions to:

Don Lancaster
Synergetics
Box 809-EN
Thatcher AZ, 85552
Tel: 520-428-4073

US email: don@tinaja.com
Web page: http://www.tinaja.com

A very useful magazine in this area is Randy Robert's *Spread Spectrum Scene* (www.sss-mag.com). An essential text is *Radiation of Nonsinusodial Electromagnetic Waves* by Helman Harmuth. More details on this text at my Web site (www.tinaja.com/amlink01.html).

What Good Is It?

OK; now that we know what pulse radio is, what good is it? Well, it is useful for modems for openers. With it, data communications inside of buildings have fewer multipath and interface problems. Outside, you get longer distances on lower power. Communication is more secure, since it is insanely harder to detect by a third party. And Internet ISPs can hang a pulse radio on every tree, giving you fast, "always connected" net access while saving them lots of phone bills.

Next, consider, vehicular safety radars. Those would be located in front for thruway "safe distance" driving, on the sides as a parking aide, and in the back as a garage-wall alarm.

The really big deal in computer animation these days is called motion capture where a dancer or actor has enough sensors on them that their avatar alter ego can realistically track them in real time. Things get sticky fast here when you have a room full of actors or need enough sensors that are cheap enough for faithful joint renditions. Pulse radio is poised to dramatically lower the costs for this application.

Prisons are an obvious use; they could allow the location of each inmate to be continuously monitored. The same goes for firemen. Or soldiers on a battlefield where each has their own IFF (Identification Friend or Foe) capability. And by odious big brother extensions, if everybody had to wear one of these, all traditional crimes would surely decrease.

Other applications include accurate distance measurements, inventory control, smart highways for vehicle navigation, pagers, security and surveillance, and personal "body" networks (where you link your worn pager, cellphone, GPS receiver, calculator, wristwatch, EKG monitor, TV set, Internet module, e-mail display, Furby, and a coffee grinder together, for better or worse).

Pulse radio offers strong ground penetration properties, given suitable antenna coupling and careful design. That

BOOKS ON OR BY RICHARD FEYNMAN

Feynman (James Glick)
The Meaning of it All: Thoughts of a Citizen... (Richard Feynman)
The Beat of a Different Drum (Jagdish Mehra)
The Character of Physical Law (Richard Feynman)
Feynman Lectures on Computuation (Richard Feynman)
Feynman Lectures on Gravitation (Richard Feynman)
Feynman Lectures in Physics I-III (Richard Feynman)
No Ordinary Genius (C. Sykes)
Photon-Hadron Interactions (Richard Feynman)
QED: The Strange Theory of Light & Matter (Richard Feynman)
Quantum Electrodynamic (Richard Feynman)
Six Easy Pieces (Richard Feynman)
Statistical Mechanics: A Set of Lectures (Richard Feynman)
Surely You're Joking Mr. Feynman (R. Feynman)
Theory of Fundamental Processes (Richard Feynman)
What Do You Care What Other People Think? (Richard Feynman)

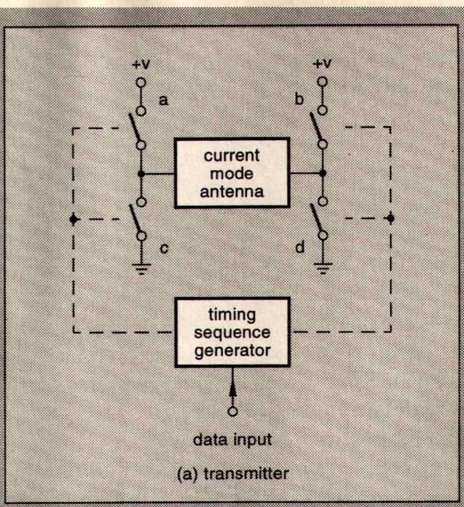
For more details, see
www.tinaja.com/amlink01.htmlamlink01

leads to all sorts of applications such as measuring the thickness of a glacier; finding the condition of buried steel in a bridge; doing archaeological mapping, utility-pipe finding, land-mine recovery; and even treasure hunting. I'm especially fascinated by the possibility of applying lower-frequency "holographic" arrays of pulse radio to cave exploration.

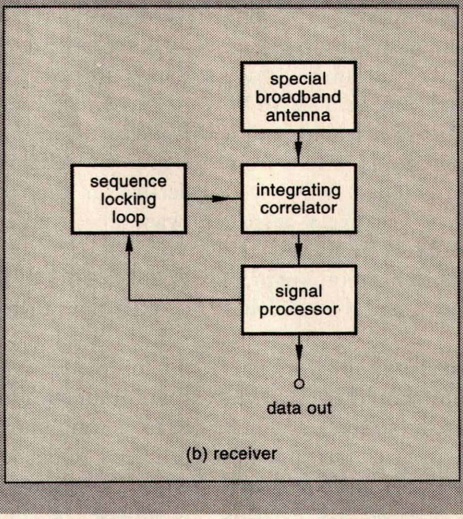
Does pulse radio take us back to the time of spark gaps where the loudest signal will always win? Not really, because most impulse radio applications will usually be micropower and have strictly limited ranges. But too many impulse-radio systems in too small an area clearly will raise the background noise level for all other communications schemes. And a wimpy nearby signal clearly might trash a distant strong one.

There's a side effect to pulse radio that raises serious SETI exploration questions. We are just beginning to learn that efficient communication is real hard to tell from low levels of noise. Supposedly smart civilizations probably have stopped blasting narrow spectrum radio power into space. Two predictions: (a) today's SETI searches, while admirable, are looking for the wrong signals in the wrong way in the wrong places; and (b) an extremely small but horribly significant portion of what seems to be galactic noise is in fact intelligent communications.

This one may take a while to sort out completely.



(a) transmitter



(b) receiver

FIG. 3—SIMPLIFIED BLOCK DIAGRAMS of a typical pulse-radio transmitter and receiver. Gaussian pulses are transmitted simply by suddenly changing the current in an antenna. Fancy codes that determine pulse timing convey information or measure distances.

Brain Parity

A few years back, I made the big prediction that we'd have human-brain capable computers right about now. Well, you might have noticed that these aren't a loss leader at Wal-Mart quite yet.

On the other hand, the unused "between keystrokes" capacity of the Web on an average day certainly is a lot larger than human-brain size. And lots of other examples can be found of specialized computing systems that do go way beyond human abilities.

There's a new "must read" book titled *The Age of Spiritual Machines* by Ray Kurzwell. He convincingly predicts $1000 brain-parity machines in less than two decades, and better machines that routinely will offer 1000× human capability in three or less.

Kurzwell is rather big on neural nets, since this is his bag. My own feelings are that other non-neural architectures should be able to do much more much better. That's because neural nets came about under severe engineering restraints, being "wet-ware," slow, and chemical, and, above all, because they are forced to evolve gradually. A foremost engineering rule is that whenever you excessively constrain a parameter, something else has got to give.

Nonetheless, neural nets certainly should be explored and developed. Kurzwell's book and his references are a superbly good starting point. He also addresses brain I/O and all the incredible potential of being able to real time read and write to individual live human neurons, some of which hints at immortality.

There is definitely a buck to be made here. After all, most any used-car salesman would gladly pay $19.95 for a remote control that has three buttons on it marked "enter lot," "buy," and "go away," and the BMW dealers might even spring extra for the $29.95 lilac scented and rosewood inlaid version.

Much more info on *The Age of Spiritual Machines* can be found at http://www.tinaja.com/amlink01.html; don't miss this one.

Home Bookbinding

With one glaring exception, home book-on-demand publication has now arrived. Thanks both to Acrobat and duplexing PostScript laser printers, you can easily publish all your own books at very low cost, one at a time, on a when and as needed basis. But a lower cost binding solution remains an elusive dream.

I have personally still been using

ULTRA WIDEBAND WORKING GROUP—

This appears to be the main clearing house. Their Web site is up at www.uwb.org. You subscribe to their discussion group by sending a message to fcc_uwb_noi-request@umunhum.stanford.edu with subscribe in the subject line of your e-mail.

OTHER WEBSITE ADDRESSES—

www.aetherwire.com
commsci.usc.edu/ulab/ulab.html
www.com21.com
www.htc.honeywell.com
www.interval.com
www.llnl.gov
www.sensoft.on.ca
www.sss-mag.com
www.tapr.com
www.time-domain.com
www.trw.com
www.uwb.org
www.zircon.com

SEVERAL KEY PAPERS—

Are found at www.time-domain.com and also at www.llnl.gov

AN IMPORTANT BOOK—

Radiation of Nonsinusodial Electromagnetic Waves H. Harmuth

SOME RESEARCHERS—

Aether Wire & Location
5950 Lucas Valley Road
Nicasio, CA 94946
(415) 662-2055

Honeywell Technology Center
3660 Technology Road
Minneapolis, MN 55418
(612) 951-7226

Interval Research
1801 Page Mill Road #C
Palo Alto, CA 94034
(650) 424-0722

Lawrence Livermore Lab
7000 East Avenue
Livermore, CA 94550
(925) 422-1100

Sensors & Software
1091 Brevik Place
Mississauga, ONT Canada
L4W3R7
(800) 267-6013

USC Electrical Engineering
Comm Sciences Institute
Los Angeles, CA 30089
(213) 740-7832

Spread Spectrum Scene
Box 2199
El Granada, CA 94018
(650) 726-6849

Time Domain Corporation
6700 Odyssey Drive
Huntsville, AL 35801
(256) 922-9229

TRW Incorporated
One Space Park
Redondo Beach, CA 90278
(216) 291-7000

Tucson Packet Radio
8987 East Tanque Verde
Tucson, AZ 85749
(940) 383-0000

Xtreme Spectrum
1077 30th St NW #311
Washington, DC 20007

Zircon Corporation
1580 Dell Avenue
Campbell, CA 95008
(408) 866-8600

FIG. 4—A COLLECTION OF pulse-radio resources.

Unibind and Pentabind products, but sorely would like to use something better. The latest of Unibind thermal binders have a steel "U" shaped strip in them. The good news is that the backs always end up solid, wrinkle free, and square. The bad news is that you have to carefully match pages and paper thicknesses. Worse yet, you cannot trim these binders using an ordinary paper shear.

Chet Novicki has just published *Perfect Binding Handbook—Making Trade Paperbacks by Hand.* Chet found that ordinary hardware store flexible contact cement makes a dandy bookbinding glue. He also has come up with some clamps and a simple process that lets you bind books that look just like the ones in the bookstore. Included are detailed how-to instructions to build your own clamps.

A 5½ by 8½ cover is often the easiest, usually using some heavier coated stock. The trick is to start with a legal-sized cover stock, leaving all of the scrap on the front end of the book. A simple trimming solves the dilemma of needing a spine width over and above the size of a regular folded page.

Besides Chet, the Paper Plus chain is one great place to get materials. There's also over a dozen direct-mail paper outfits who also sell in small quantities. More on this is in RESBN66.PDF on my site, and at www.tinaja.com/bod01.html.

Chet can be reached through his www.gigabooks.com site. Besides binding books, he also sells low-cost binding machines, materials, supplies, and his consulting services. An extensive listing of bookbinding books appears at www.tinaja.com/amlink01.html. More on Acrobat at www.adobe.com and www.tinaja.com/acrob01.html. And much more on BOD are in my book-on-demand Resource Kit and at http://www.tinaja.com/bod01.html.

Richard Feynman

I've long been a Richard Feynman fan. For those unfamiliar with him, he discovered fundamental quantum mechanics. In his spare time, he built the atom bomb, made physics understandable to legions of students, solved the Challenger space accident, cracked safes, infuriated security personnel, and expertly played bongos. I've gathered a few of the better books by or about him together in the nearby listing.

New Tech Lit

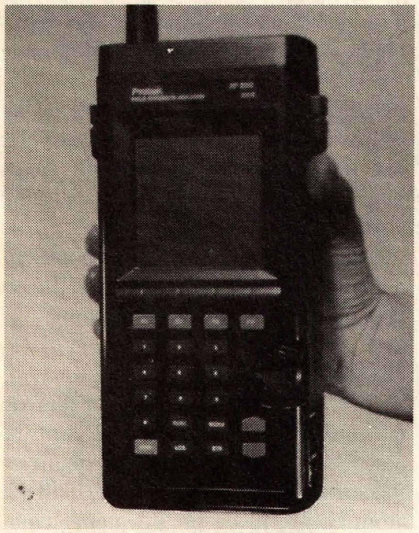
From Analog Devices, comes the *Winter 1999 Short Form Catalog.* From Texas Instruments, there's a *Convert Analog CD-ROM* about analog-to-digital and digital-to-analog conversions. From International Rectifier, there's a new data book on power semiconductors.

From Linear Technology, check out *Design Note 161* on "smart rock"

Continued on page 97

Field Strength Analyzer

WITH THE BATTERY-OPERATED, Protek 3201 handheld 2-GHz RF field strength analyzer, RF engineers can make quick, accurate RF field measurements of any communications installation or equipment from 100 kHz to 2060 MHz. Phase-lock-loop circuitry assures precise tuning and frequency stability with 3-ppm accuracy. This 24-ounce instrument automatically scans 160 channels in selectable steps and offers the convenience of manual, memory, and search scans. A built-in frequency counter provides 50-ppm with 120-mV input sensitivity. The large, easy-to-read backlit LCD offers a variety of display formats including bargraphs. There is also a spectrum display and an audio output stage with a built-in speaker and a volume control for monitoring signals.


CIRCLE 20 ON FREE INFORMATION CARD

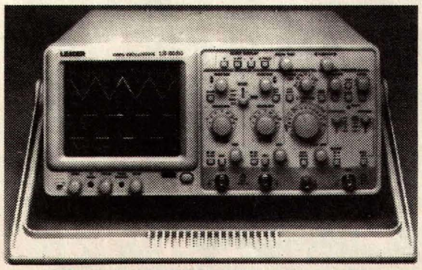
The 3201 can be used to test, measure, install, and maintain RF equipment including wide-band and narrow-band FM transmitters; single-sideband and AM systems; cable television; TV and radio broadcast equipment; PCs and paging systems; antenna sites; cellular, cordless, and mobile telecom communications systems; marine radio and navigation systems; and to perform EMC compliance testing.

Test setups and measurements can be stored in internal memory, while all functions are menu or GUI selectable. An RF-232 interface is available. Direct hard copy printouts are also possible via a printer port connection. There is a Copy Set Mode to permit DMA of channel setup and data values. The 3201 sells for $2100.

HC PROTEK
154 Veterans Drive
Northvale, NJ 07647
Tel: 201-767-7242
Fax: 201-767-7343
e-mail: hcprotek@aol.com
Web: www.hcprotek.com

Delayed Sweep Oscilloscope

THE LS8050, A DUAL-CHANNEL, laboratory-grade 50-MHz delayed-sweep oscilloscope offers bright, sharp traces along with superior stability. With a 1mV/div sensitivity and 15-MHz bandlimiting at 1 and 2mV/div, this high-performance instrument can closely examine small parts of the main time base sweep signal. It incorporates TV-V and TV-H trigger capabilities along with a trigger lock function to establish the trigger point within the peak-peak signal swing.

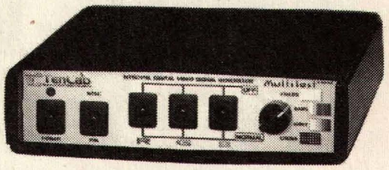

CIRCLE 21 ON FREE INFORMATION CARD

Other important features include variable hold-off to view complex waveforms; X–Y operation; a scale illuminator to facilitate waveform photography; and a CH1 output, which enables the CH1 amplifier to operate as a high-gain, calibrated pre-amp. The LS 8050 sells for $945.

LEADER INSTRUMENTS CORP.
380 Oser Avenue
Hauppauge, NY 39762
Tel: 800-645-5104 or 516-231-6900
Fax: 516-231-5295
e-mail: gonos@aol.com
Web: www.leaderusa.com

Signal Generators

LARGE SCREEN TVS AND VIDEO projectors may become misadjusted or misaligned due to vibrations or to the presence of magnetic fields generated by electronic equipment, speakers, etc. Even the quality of brand-new units might be improved by optimizing factory settings and adjustments. The MultiTest 100 and MultiTest 200 are high-performance digital video generators that generate high-precision professional patterns that TV stations, engineers, and technicians themselves use to test TV and video equipment. The instruments help establish which problems may be corrected by the consumer or if a technician needs to be called in.


CIRCLE 22 ON FREE INFORMATION CARD

The MultiTest 100/200 generate multiple NTSC and PAL patterns via composite-video, S-video, and RF. No technical background is needed, and these units are easy to use. A comprehensive instruction booklet shows how to check for accuracy in color purity, focus, white balance, convergence, tint, and sharpness. The MutliTest 100 (NTSC 3.58, PAL 4.43) and the MultiTest 200 (NTSC 3.58, NTSC 4.43, PAL 4.43, PAL-M, PAL-N) sell for $399 each.

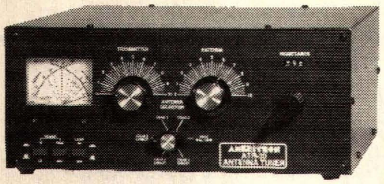
TENLAB MULTISYSTEM VIDEO PRODUCTS
27346 Oak Summit Road
Agoura Hills, CA 91301-3612

Tel: 818-706-8120
Fax: 818-706-3643
e-mail: info@tenlab.com
Web: www.tenlab.com

Antenna Tuner

THE TRUE LEGAL ANTENNA Tuner (ATR-30) allows sustained true RF output levels of over 1500-watts continuous carrier into most load impedances. It also handles 3000-watts continuous SSB and CW duty even on 160 meters. The illuminated cross-needle true peak-reading SWR/wattmeter measures peak or average forward and reflected power plus SWR.

Its high-Q, high-current, edge-wound silver-plated roller inductor and high-tuning capacitance (500 pF) gives true high-power performance, handling extreme voltages and currents without arcing or heating. The ATR-30 uses a roller inductor T-matching network that can match nearly any antenna using either coax or balanced feedlines. The tuner covers 1.8 to 30 MHz, including all MARS and WARC bands. The ATR-30 has a suggested retail price of $599.


CIRCLE 23 ON FREE INFORMATION CARD

AMERITRON
116 Willow Road
Starkville, MS 39759
Tel: 800-713-3550
Fax: 601-323-6551
e-mail: mfj@mfjenterprises.com
Web: www.ameritron.com

Solar-Powered Radio

THE FREEPLAY SELF-POWERED Radio with Solar is powered by a solar cell. In situations where sunlight is limited or unavailable, the AM/FM broadcast-band radio provides up to an hour of listening with 30 seconds of winding. It is available in a variety of models and colors, such as red, teal, and blue, as well as a clear case that shows the internal spring motor.

The radio's Freeplay Generator is a hand-wound spring mechanism that transforms mechanical energy into electricity. A textured carbon steel spring is energized by winding it from one spool to another. As the spring returns to its original position, it releases energy and applies a rotational torque into a transmission. The transmission consists of a gearbox that drives a DC generator to provide the energy for the radio. The Freeplay Self-Powered Radio has a suggested retail price of $79.95.

CIRCLE 24 ON FREE INFORMATION CARD

BAYGEN POWER USA INC.
80 Amity Road
Warwick, NY 10990
Tel: 800-WIND 234 or 914-258-5660
Fax: 914-258-3213
Web: www.freeplay.net

Miniature Video Camera

This color video camera, the PC-87XS, is said to be the world's smallest color CCD unit, measuring 1.05 ×0.88 inches and weighing only ⅓ ounce. The camera has a resolution of 350 lines, a low-light rating of 5 lux, operates on 5-volts DC, and draws only 5 milliamps.

The camera uses an MCM PCB design and includes a 10-bit digital signal processing chip. This circuitry constantly monitors the lighting conditions and makes corrections hundreds of times per second. The user simply powers it up, and points and shoots. Applications include surveillance, airborne video, videoconferencing, and robotics. It is available with a standard microlens or covert pinhole style lens. The PC-87XS sells for $99.95.

CIRCLE 25 ON FREE INFORMATION CARD

SUPERCIRCUITS
One Supercircuits Plaza
Leander, TX 78641
Tel: 800-335-9777 or 512-260-0333
Fax: 512-260-0444
e-mail: sjk@supercircuits.com
Web: www.ssupercircuits.com EN

TECH MUSINGS

continued from page 95

micropower transponders. And from Allegro Microsystems, there's a free CD-ROM dataguide on chips, sensors, and power drivers.

The MEMSCAP *MEMS Universe* is a freebie new data CD. Subtitled "The Power of a Small World," this one is on microminiature nanotechnology—stuff like micro mirrors, resonators, comb fingers, electrostatic motors, tiny inductors, and even unbelievably small hinges. You can pick up more details at www.memscap.com.

Free samples this month include plastic "wire" binding samples from Plastikoil, and expandable sleeving from Brand Dielectrics. Featured trade journals include *Electronics Cooling*, *Vision Systems*, the pricey *Smart Card Alert* newsletter, and *Inside Finishing*, which is all about hot stamp technology.

Besides running forums and other useful activities, The Society of Amateur Scientists publishes their *Amateur Scientists Bulletin*. You can visit them at www.sas.org.

For most individuals most of the time, any involvement with patents is almost certainly going to result in a monumental loss of time, energy, money, and sanity. Find out exactly why, along with tested and proven real world alternatives in my *Case Against Patents* package as per my nearby Synergetics ad, or check out www.tinaja.com/patnt01.html.

I just made some major upgrades to both my Acrobat Library and my webmaster library shelves found at www.tinaja.com/acrob01.html and www.tinaja.com/weblib01.html. See www.tinaja.com/info01.html for lots of instant research solutions and my www.tinaja.com/barg01.html for some incredible surplus electronic bargains.

As usual, most of the mentioned items are in our Names & Numbers or Feynman Books sidebars. Always check here first before calling our no-charge US help-line shown in the service box. Let's hear from you. EN

Trees Make a World of Difference™
Find out how trees can make a world of difference for you, and your neighborhood. For your free brochure write: Trees For America, The National Arbor Day Foundation, Nebraska City, NE 68410.
The National Arbor Day Foundation

ADVERTISING INDEX

Electronics Now does not assume any responsibility for errors that may appear in the index below.

Free Information Number		Page
—	Abacom Technology	56
—	ABC Electronics	52
—	AES	70
213	Alfa Electronics	58
214	All Electronics	67
—	Allison Technology	75
—	Amazon Electronics	76
270	American Eagle Publications	48
—	Andromeda Research	71
—	Arrow Technologies	77
—	Basic Electrical Supply	48
204	Beige Bag	59
—	Brand Electronics	50
322	C&S Sales, Inc.	54
—	Cable USA	78
—	Circuit Specialists	56
—	CLAGGK, Inc.	7
—	Cleveland Inst. of Electronics	35
—	Command Productions	50
—	Computer Monitor Maintenance	81
226	Consumertronics	51
234	Dalbani Electronics	65
235	Danbar Sales	66
—	EDE - Spy Outlet	78
—	Electronic Tech. Today	62, 78
—	Emac Inc.	75
—	Fair Radio	49
335	Foley-Belsaw	69
—	General Device Instruments	72
—	Global Electronics	60
—	Grantham Col. of Engineering	12
329	Graymark International	59
—	Grich RC Inc.	60
—	Home Automation	72
331	Howard Electronics	73
—	Howard Electronics	77
337	H&R Company	74
—	Information Unlimited	66
—	Intec Automation	76
138	Interactive Image Technologies	CV4
—	Intronics, Inc.	72
319	IVEX Design	71
—	J&M Microtek, Inc.	76
—	J-Tron Inc.	77
—	James Electronics	63
—	KNS Instruments	52
—	LaMantia Products	60
—	Lynxmotion	68
—	M^{2}L Electronics	52
325	Mark V Electronics	48
—	MAXNC	78
327	MCM Electronics	CV3
251	Mendelson Electronics Surplus	52
304	Merrimack Valley Systems	70
133	MicroCode Engineering	CV2
—	microEngineering Labs	68
—	Midwest Laser Products	49
—	Modern Electronics	52
—	Mondo-tronics Inc.	63
318	Mouser Electronics	77
—	MSC Electronics	76
—	Netcom	49
—	NRI Schools	19
334	OWI	60
—	Pioneer Hill Software	72
222	Polaris Industries	47
315	Prairie Digital	75
264	Print (Pace)	53
—	Pro Planet	78
266	Ramsey Electronics	79
283	Resources Unlimited	57
—	Securetek	77
—	Sil Walker	68
—	Square 1 Electronics	50
—	Super Circuits	63
—	Tech-Specialties	76
—	Techniks	76
—	Technological Arts	76
312	Telulex	51
333	Test Equipment Depot	64
217	Test Equipment Sales	64
275	Timeline	58
—	U.S. Cyberlab	70
282	Velleman	61
—	Visitect Inc.	56
—	Weeder Technologies	68
132	Windjammer Barefoot Cruises	12
—	World Star Technologies	77
—	Worldwyde	76, 77
—	Zagros Robotics	74

ADVERTISING SALES OFFICES

Gernsback Publications, Inc.
500 Bi-County Blvd.
Farmingdale, NY 11735-3931
Tel. 516-293-3000
Fax: 516-293-3115

Larry Steckler
Publisher (ext. 201)
e-mail: advertising@gernsback.com

Adria Coren
Vice-President (ext. 208)

Ken Coren
Vice-President (ext. 267)

Christina Estrada
Assistant to the Publisher (ext. 209)

Marie Falcon
Advertising Director (ext. 206)

Adria Coren
Credit Manager (ext. 208)

For Advertising ONLY

EAST/SOUTHEAST
Megan Mitchell
9072 Lawton Pine Avenue
Las Vegas, NV 89129-7044
Tel. 702-240-0184
Fax: 702-838-6924
email: mmitchell@gernsback.com

MIDWEST/Texas/Arkansas/Okla.
Ralph Bergen
One Northfield Plaza, Suite 300
Northfield, IL 60093-1214
Tel. 847-559-0555
Fax: 847-559-0562
email: bergenrj@aol.com

PACIFIC COAST
Anita Bartman
Hutch Looney & Associates, Inc.
6310 San Vicente Blvd., Suite 360
Los Angeles, CA 90048-5426
Tel. 323-931-3444 (ext. 227)
Fax: 323-931-7309
email: anita@hlooney.com

Electronic Shopper
Joe Shere
National Representative
P.O. Box 169
Idyllwild, CA 92549-0169
Tel. 909-659-9743
Fax: 909-659-2469
email: joe@greencafe.com

Megan Mitchell
National Representative
9072 Lawton Pine Avenue
Las Vegas, NV 89129-7044
Tel. 702-240-0184
Fax: 702-838-6924
email: mmitchell@gernsback.com

Customer Service
1-800-999-7139
7:00 AM - 6:00 PM M-F MST

MCM ELECTRONICS®

The Source For All Of Your Electronics Needs

When ordering, please provide this code: ▶ **SOURCE CODE: ENS58**

Prices Effective April 16 through May 28, 1999

For over 20 years, MCM has been the leading supplier to the electronics service industry. Huge inventory, rapid delivery and competitive prices have made MCM the choice for:

- Hobbyists
- Service Technicians
- Educators
- Installers

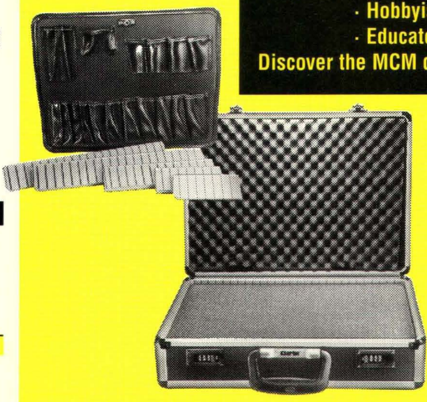
Discover the MCM difference, call today for your free catalog.

As Low As $2.99

Nickel-Metal Hydride Cells

Get NIMH performance in a standard "AA" or "AAA" cell. Performance is 50% over that of Ni-Cad batteries of the same size. Sold individually.

Order #	Size	(1-9)	(10-49)	(50-up)
29-2615	"AAA"	$3.59	$3.29	$2.99
29-2620	"AA"	4.19	3.89	3.59



ONLY $34.95 Order #21-3462

Clarke

Aluminum Tool/Equipment Case

Includes one tool pallet and pre-cut foam bottom. Ideal for carrying test equipment with small hand tools and accessories. Black finish, measures approximately 19" x 14" x 6". **Regular price $51.50.**

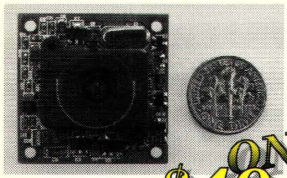
ONLY $39.95

Order #72-4025

TENMA®

DMM W/Logic Function

3½ digit DMM measures AC/DC voltage from 200mV~600V, resistance to 2000Mohm, capacitance to 20μF, transistor hFE gain and audible continuity test. Requires 9V battery (#290-080) not included. Dimensions: 2¾" (W) x 5¾" (H) x 1½" (D). **Regular price $65.95.**



Order #82-2990 ONLY $49.00

DEFENDER SECURITY

Micro PC Board Camera

B/W CCD camera measures only 1¼" x 1¼" x 1". Provides NTSC composite video output. Built-in 3.6mm lens provides viewing angle of 92°. Requires 12VDC, 300mA. (#58-3330 AC adaptor). **Regular price $64.95**

ONLY $9.95

Order #55-1190

MCM AUDIO SELECT™

8" Rubber Surround Polypropylene Woofer

Popular woofer design is the foundation of many home and auto speaker systems. 70W/100W RMS/peak capacity, frequency response 30Hz~3.5KHz. 8ohm. Other sizes available. **Regular price $13.50**

CSB BATTERY

12V Sealed Lead Acid Battery

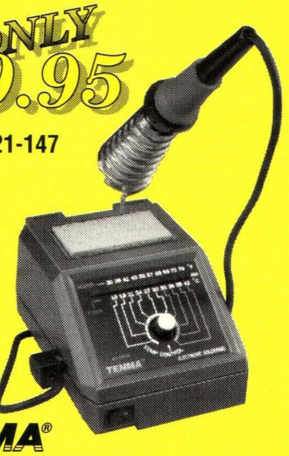
Ideal for alarm panels, lighting or any type of battery back-up application. Rated 4.5Ah. ¼" tabs accept standard female quick disconnects. Dimensions: 3½" x 2⅝" x 4". **Regular price $26.95**

ONLY $14.95

Order #29-1335

ONLY $49.95

Order #21-147



TENMA®

Solder Station

Perfect for most soldering applications including SMD. Overheat protection with closed loop temperature control provides precise heat. Includes replaceable iron clad conical ³⁄₆₄" tip. Linear LED display shows operating temperature. **Regular price $79.95.**

Order #28-2200

ONLY $9.95

Multi-Voltage Power Supply

Fully regulated supply provides up to two amps, at the following selectable voltages: 3, 4½. 6V, 7½V, 9V, 12V. **Regular price $16.95.**

FREE Catalog!

1-800-543-4330

www.mcmelectronics.com

Hours: M~F 7 a.m.~9 p.m., Sat. 9 a.m.~6 p.m., EST.

Same Day Shipping!

In stock orders received by 5:00 p.m. (YOUR TIME), are shipped the same day.

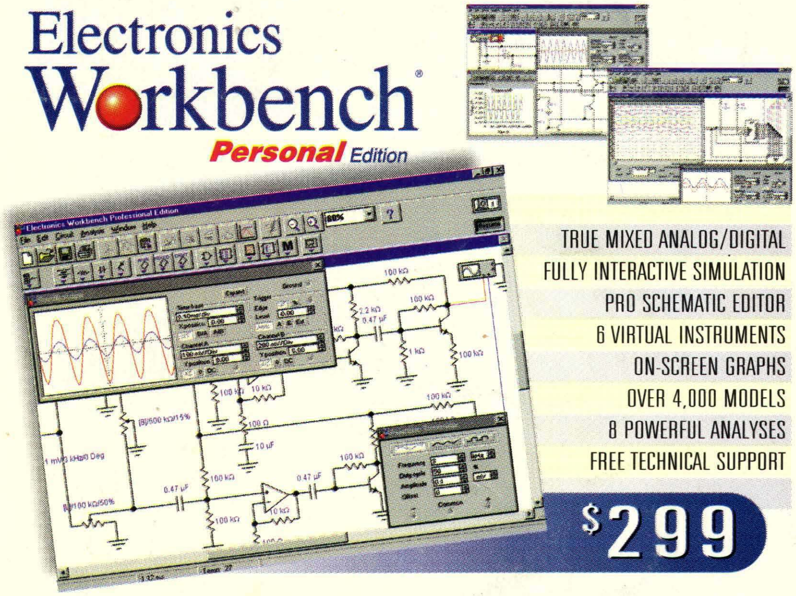
mcm

MCM ELECTRONICS®
650 CONGRESS PARK DR.
CENTERVILLE, OH 45459
A **PREMIER FARNELL** Company

SOURCE CODE: ENS58

THE WORLD'S MOST POPULAR DESIGN TOOL CHOSEN BY OVER 100,000 USERS!

Electronics Workbench® *Personal* Edition

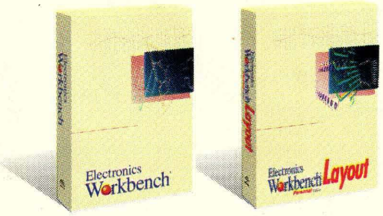


TRUE MIXED ANALOG/DIGITAL
FULLY INTERACTIVE SIMULATION
PRO SCHEMATIC EDITOR
6 VIRTUAL INSTRUMENTS
ON-SCREEN GRAPHS
OVER 4,000 MODELS
8 POWERFUL ANALYSES
FREE TECHNICAL SUPPORT

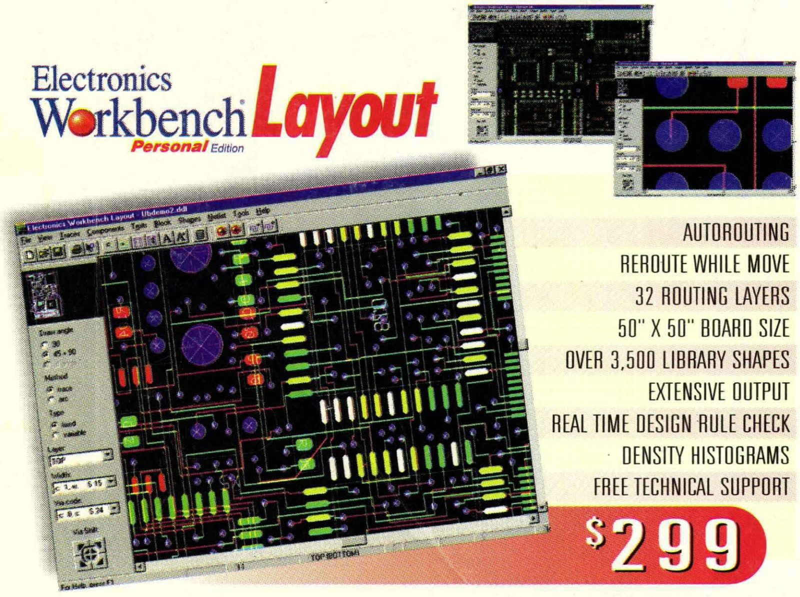
$299

Full-featured schematic capture and SPICE circuit simulation!

The world's most popular circuit design tool that sets the standard for powerful, insightful SPICE simulation. Create professional looking schematics and then with the flick of a switch, display simulated waveforms live on a suite of virtual instruments. Includes 15 powerful analyses and a library of over 4,000 robust component models.



Electronics Workbench Layout *Personal* Edition



AUTOROUTING
REROUTE WHILE MOVE
32 ROUTING LAYERS
50" X 50" BOARD SIZE
OVER 3,500 LIBRARY SHAPES
EXTENSIVE OUTPUT
REAL TIME DESIGN RULE CHECK
DENSITY HISTOGRAMS
FREE TECHNICAL SUPPORT

$299

Power-packed PCB layout with autorouting and real-time DRC!

EWB Layout is a powerful board layout package for producing high-quality, multi-layer printed circuit boards. Offering tight integration with our schematic capture program, EWB Layout is the best way to quickly produce well-designed boards.

BUY BOTH AND SAVE! ~~$598~~ $548

30-DAY MONEY-BACK GUARANTEE

CALL FOR INFORMATION AND PRICING ON OUR PROFESSIONAL EDITION.

800.263.5552

Fax: 416-977-1818
E-mail: ewb@interactiv.com

INTERACTIVE

For a free demo, visit our website at **www.electronicsworkbench.com**

CIRCLE 138 ON FREE INFORMATION CARD